Teamwork and Safety in the Maritime Industry:

A SWOT Approach

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December 2010

Acknowledgements

First and foremost I would like to express my gratitude to my fellow student Anine Charlsen for good cooperation throughout this project. Her understanding and support was highly valued and gave me motivation to continue even when extraordinary challenges emerged along the way.

The ship owning company involved in the study gave us the opportunity and made the project possible, and I am grateful to the management of the company for their kind assistance. A lot of effort was put into giving us the relevant information about the organisation and the industry, and in making the necessary arrangements for our data collection. The contributions from the participants in the study were much appreciated. Their will to share their reflections about their teams and teamwork with us was essential in order to perform the study.

I would like to thank my main supervisor Cato Alexander Bjørkli at the Department of Psychology, University of Oslo. His guidance and support, and his competent and constructive feedback during the various steps of the work on the project, was highly appreciated. I would also like to thank supporting supervisor Thomas Hoff, who was involved in the project when it first started.

Last but not least I would like to thank my mother Inger Vestad, for her unconditional love and support, and for always having faith in me and my projects. She was struck by sudden and terminal illness, and passed away while I was still engaged in the project, and unfortunately did not live to see this thesis completed. I would like to dedicate this paper in memory of my mother. I am also grateful for the encouragement and support from my father, my fiancé, my family, and close friends; their belief in me has given me the inspiration and the motivation necessary to complete the project while I am still recovering from serious illness. Finally many thanks to Erik Vasaasen for his useful comments during the finishing stage of the project.

Oslo, December 2010

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Table of Contents

Abstract

The past few decades the use of teams has increased, also in complex sociotechnical systems such as the maritime industry. Safety issues involve a wide range of elements, including human factors, and pose a number of challenges to organisations in the shipping industry. The primary aim of this study was to examine the Big Five of teamwork model and its ability to capture teamwork aspects of all kinds of teams, independent of team type, organisational level and domain. The collection of data was done through performing semi-structured interviews with open-ended questions structured in accordance with a SWOT framework.

The study was carried out in an organisational network in the maritime domain. The sample consisting of 39 participants representing three different teams and organisational levels were all male. The Core team consisted of employees of ship management companies, while the Top officers team and the Ratings team represented the crew on board vessels. The Big Five model captured 60% of all the SWOT statements generated through the interviews and accounted for a significantly higher number of statements than the residual, confirming the model's ability to capture teamwork. Performing a content analysis of the statements not accounted for by the Big Five, amounting to 40% of the SWOT statements, revealed that these statements were relevant for teamwork, constituting a meaningful residual.

The anticipation that the teams put different emphasis upon the various components of the Big Five model, and that the profile would differ depending upon organisational level, was confirmed.

Introduction

The maritime domain has vital importance for the global community, as the shipping industry plays a major role in providing sea transportation for a wide range of commodities world wide. As a seafaring nation, Norway has long and proud traditions in this industry, and the maritime sector remains important for the Norwegian society. The report Maritim21, first published in June 2010, states the authorities' policies regarding further development of the maritime sector, with special emphasis on environmental and safety challenges. The report establishes the ambitious goal that Norway should be among the world's leading seafaring nations in 2020 ("Maritim21," 2010). In order to comply with the changing requirements in the environment and meet with their own objectives, organisations in the maritime industry have to prepare themselves to be able to perform effectively and safely (Bjørkli, 2007). This could be done through learning and training efforts, and it could be done through the way the work is structured, for example a team-based organisation. The focus in this paper will be teams and teamwork in the shipping industry, and the perspective will be according to the Big Five of teamwork model (Salas, Sims, & Burke, 2005). The use of teams has gained increased importance for organisations in general during the past few decades, and more work is now performed by teams (Eby & Dobbins, 1997; Salas et al., 2005; Sasou & Reason, 1999; Sundstrom, 1999; West, 2004). Teams are also important in complex sociotechnical systems (Salas et al., 2005), including in organisational networks in the shipping industry (Grech, Horberry, & Koester, 2008; Weintrit, 2009). Much of the focus connected to teams and teamwork has been directed towards team effectiveness and performance. Seeing these elements in connection with safety issues implies an extra dimension and further challenges to consider.

The Shipping Industry as a Complex System

Organisations in the shipping industry are highly complex sociotechnical systems (Bjørkli, 2007). Complex systems comprise the people and how they interact with their work environment, consisting of task, environment, and equipment (Arslan & Er, 2008). Hence the key aspects in complex systems involves how the people interact with the various elements in their work environment, how they interact with each other, and how these interactions affect the accomplishment of the tasks. Important elements in this picture are termed as human factors, the man-machine interface, and interdependence (Lorenzo, 1990; Meister, 1989; Reason, 1990; Vicente, 1999; Vicente, 2003). The focus of attention in human factors can be

both the individual and/or the team, but always in relation to and as part of the system as a framework. The human performance can only be understood in relation to that framework, and must be interpreted in terms of accomplishment of the task purpose, which is tightly linked to the system (Meister, 1989). Due to the interdependence between the human elements and the system, it is assumed that when one part of the system functions well and performs effectively, the other part will usually also be satisfactory.

Safety Issues in Complex Systems - Safety in the Maritime Domain

Organisations in the maritime domain are considered to be high-risk organisations, as marine accidents imply potentially catastrophic consequences (Emad & Roth, 2008; Hetherington, Flin, & Mearns, 2006; Perrow, 1999). Thus the focus upon safety is essential in the shipping industry. There has been much attention regarding safety issues, and considerable endeavours have been made intending to improve the maritime safety (Celik & Cebi, 2009).

Traditionally there has been focus upon the hardware elements, and a lot of effort has been put into designing and constructing better and safer ships, developing more accurate and reliable navigational instruments, and supplying various types of safety equipment on board the vessels (Hetherington et al., 2006). Due to the technological evolution during the recent decades with a continuous development and improvement of technology in general, the vessels and the technical equipment on board the ships are safer than ever before (Rasmussen, 1990), which has also contributed a great deal to improve safety in shipping.

According to statistics and compared to other industries, the number of accidents in the maritime industry is relatively small (Hetherington et al., 2006). However accidents and incidents still occur, and due to many incidents and a number of major accidents, some with severe consequences (Dekker, 2005; Hetherington et al., 2006; Perrow, 1999; Reason, 1990), safety remains an essential matter of attention in the industry and has maybe become even more important the last couple of decades (Celik & Cebi, 2009, Hetherington et al., 2006; Perrow, 1999). The Exxon Valdez accident off the Alaskan coast in 1989 is only one example of many illustrating the major consequences marine accidents can have both for human beings, for organisations, and for the society as a whole.

Engaging with safety issues in the shipping industry is a rather complex matter. As a complex sociotechnical system involves the human element, the job, the environment, and the interaction between these components, the consideration of safety issues implies a number of challenges (Perrow, 1999). The complexity, the rapid changes, and the growing size of the technical systems have contributed to a drastic change of the nature of the human factors

problems one is faced with in industrial safety (Rasmussen, 1990), including the demand for continuous development and improvement of competence (Homsma, Van Dyck, de Gilder, Koopman, & Elfring, 2009; Norros & Nuutinen, 2009).

In complex systems the human factors challenge include the classical interface problem. It could be difficult to obtain an overview of the relational structures of accidents as a chain of events illustrating the complexity of the context, the situation, and the systems is often involved. In order to prevent or keep the number of accidents at a minimum level, it is nevertheless essential to reveal why accidents happen and gain more knowledge and further understanding about the causes of accidents. Hence risk assessment and risk management are important in the shipping industry. Even when all possible elements have been taken into consideration, risk can never be totally eliminated, and the fact that accidents are inevitable, and even normal, should be acknowledged (Perrow, 1999). It has been suggested that one of the problems in the shipping industry is the character of the system, which seems to be "error-inducing" (Perrow, 1999, p. 172). This is due to the structure of the industry itself, the social organisation of the personnel on board, economic pressure, insurance, and difficulties in international regulation. Perrow further claims that the configuration of the many components of the system induces errors and defeats attempts at error reduction. Furthermore only a total reconfiguration can make the various parts of the system fit together in an error-neutral or error avoiding manner, according to Perrow (1999).

As an important part in this picture the role of the human element has gained considerable attention, and the term human error has been referred to as a contributing factor in causing incidents and accident also in shipping (Emad & Roth, 2008; Hetherington et al., 2006; Håvold, 2005; Perrow, 1999). Wagenaar and Groeneweg (1987) analysed 100 accidents at sea, and they concluded that accidents in complicated man-machine structures usually are caused by a multitude of events which occur in a coincidental manner that was never foreseen. A complex chain of events includes a number of steps and not one single cause. This is consistent with views held by other authors (Rasmussen, 1990; Reason, 1990; Wagenaar & Groeneweg, 1987). The Norwegian Accident Investigation Board reached a similar conclusion regarding the causes of the Bourbon Dolphin accident in 2007. Hence a large number of causes, including the human element, can contribute to bringing about an accident. Only 4 of the 100 accidents in the mentioned review occurred without any preceding human error involved, consequently the human factors appear to play an important role in shipping accidents. The opposite approach to the human factor perspective as contributing to errors being made is however also relevant, promoting that an essential task of the people in

complex systems is preventing or counteracting other errors (Wagenaar & Groeneweg, 1987). Consequently the human factor is not only a potential cause of accidents, but could also be considered a contribution in accident prevention, through observing and detecting any conditions which could potentially lead to accidents or incidents.

Despite, or maybe because of, the extensive technological improvements, the work conditions have become increasingly demanding also for seafarers (Hetherington et al., 2006; Perrow, 1999). Consequently Hetherington and colleagues suggest that the so-called non-technical skills, such as situation awareness, decision making, and cognitive demands, communication, language, and cultural diversity, as well as teamwork abilities may be of vital importance when it comes to the human element and safety issues (Hetherington et al., 2006).

Organisational Networks in the Shipping Industry

Shipping is a global industry, and the people involved are placed in different locations ashore world wide, in addition to the crew on board the vessels. According to Hollnagel (2004), the terms blunt end and sharp end can be utilised to describe an organisational system. In short this implies that the people at the blunt end of the organisation are located remotely from the operations, in this organisational network typically meaning the people working in the offices of ship owners and ship management companies. The sharp end is the part of the organisation where the production actually takes place, and involves the crew on board the vessels. People working in various parts of the organisational network will not be similarly involved or affected by safety issues concerning the organisation. The people working at the blunt end of the organisation may influence safety issues through their ability and the authority to decide about resources and constraints affecting the people working at the sharp end (Hollnagel, 2004; Woods, Johannesen, Cook, & Sarter, 1994). In connection with their roles and tasks the people working at the sharp end are actually interacting with the hazardous processes (Woods et al., 1994). These people are influenced by innumerable factors and relations from within the organisation, the organisational network, and the external environment. These factors may affect the way they behave and may potentially be contributing elements when errors are made. Reason (1990) proposes that the human factor term comprise a larger range of individuals and activities than those traditionally associated with or connected to the front-line operation of a system, and claims that the more removed individuals are to the front-line activities, and consequently from direct hazards, the greater is their potential danger to the system.

Organisations in the maritime domain have some distinctive and specific features making this industry different from other industries (Håvold, 2005). Each contract the members of the ship's crew spend a certain agreed period of time on board, depending upon nationality and rank. This constitutes a rotating system of crew members. The 24/7 society on board the vessels could be perceived as a relatively closed environment and an isolated fit with all the necessary competence on the premises. While on board the ship the crew members are both each other's colleagues and friends (Østreng, 2007). Three different departments; deck, engine and galley, are each responsible for different functional areas, and much of the work on board the vessels are based upon shift work. The organisation of the crew on board the vessels is highly hierarchical, organised from the Master and downwards (Håvold, 2005; Perrow, 1999). Even though the relative manning on a ship has been drastically reduced the last three decades, the traditional organisational structure has principally remained the same. The crew is divided into senior or top officers, junior officers and ratings, and all the ranks have their specific positions, defined roles and responsibilities, different competence and tasks, all connected either to the deck department, the engine department or the galley department (Håvold, 2005; Østreng, 2007). The use of teams in order to complete tasks and achieve goals, has gained importance in many organisations, and is common also in the maritime industry. Thus it may be worth looking into which aspects that influence the teamwork functioning of teams in an organisational network in the shipping industry.

Teams and Teamwork

Teams. During the past few decades the use of teams has increased, and organisations are relying more on team-based structures in order to meet the requirements of complex environments (Salas et al., 2005; West, 2004). Teams have great potential to offer more than any one single individual possibly can offer, providing valuable solutions for the organisation. Teamwork is however no guarantee of success, as team effectiveness and team performance depend upon a well functioning team, and malfunctioning team processes can lead to team failure with unfortunate and far-reaching effects for the organisation (Salas et al., 2005).

A team can be defined as "two or more individuals with specified roles interacting adaptively, interdependently, and dynamically toward a common and valued goal" (Salas, Dickingson, Converse, & Tannenbaum, 1992). Two important aspects are determining for whether a group can be considered to be a team; namely common goal(s) and mutual interdependency in order to reach the team's common goal(s). Further team members have

specific roles and each member should be able and willing to adapt to other team members and in accordance with the task requirements.

Teamwork. A wide range of tasks and functions are assigned to teams, and these are performed or solved through teamwork. Increased use of teams and the importance of teamwork have resulted in more research regarding this topic (Guzzo & Dickson, 1996). Despite the increased use of teams and the growing interest in the teamwork topic, there is however no clear definition or specification of exactly what teamwork is in the various proposed models. A number of variables that could enhance or impede teamwork have been discussed in various papers in connection with teamwork models. However there is no agreement between the diverse authors regarding which aspects are more appropriate (Cannon-Bowers & Salas, 1997; Salas et al., 2005). General interpersonal competence and skills could however prove to be important also for the effective teamwork and team functioning irrelevant of other competencies and skills (Argyris, 1990).

Team types. Teams are complex in nature, and there is no consensus regarding team typology. The so-called "integrated teamwork skill dimensions" have been proposed as being applicable for all team types (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Salas, Burke, & Cannon-Bowers, 2000). According to the research promoting this view, there are some factors that appear to be common for all team types, independent of the team task and other specific features of the team, hence one model should apply for all team types. Other authors have made distinctions between different team types based upon the team task and the purpose of the team (Sundstrom, 1999).

Teams could alternatively be defined according to the function of the team, the roles and the responsibilities, the team task or other specifics connected to the purpose of the team. Team types range from top management teams operating in the complexity of the boardroom, relating to long term plans and future strategies to pure task teams formed to carry out and complete specific tasks (Salas et al., 2005).

Teams may operate in highly different environments and can relate to specified time frames, or the time span could be more indefinite and the life cycle of the team not clearly expressed (Sjøvold, 2006). Teams may be defined as continuous and stable teams, and once the team is formed the intention is for the team to continue functioning for as long as it is needed. Other teams may have a more temporary existence, such as project teams, which could be established to perform particular tasks or fulfil a purpose within a defined time frame, or until the assignment is fulfilled, or the task is done/carried out (Sjøvold, 2006; Sundstrom, 1999). In many teams the team members work face to face, while virtual teams

have team members spread on various locations communicating via electronic media, and yet other teams have a mix of remote team members and team members at the same location (Sundstom, 1999).

It has further been proposed to distinguish between team specific factors and team generic factors, as well as task specific factors and task generic factors. The generic factors could be applied in general across teams, while the specific factors are applicable for the particular teams or tasks (Cannon-Bowers et al., 1995; Salas et al., 2000). Consequently the different team types work under various conditions and according to different frames. The challenges they meet in their teamwork are dissimilar, and it is anticipated that the requirements of the team and the emphasis put on the various aspects relevant for their teamwork will differ according to the context and the situation, the time frame, the purpose and the goal of the team, all the various elements and the circumstances the team have to relate to and operate in accordance with (Salas et al., 2005; Sjøvold, 2006).

The Big Five of Teamwork Model

Intending to find an answer as to what teamwork is, Salas and colleagues conducted a literature review of publications on team and teamwork over the past 20 years. Based upon the review they derived a model intending to cover all types of teamwork in any organisation across domains (Salas et al., 2005). The model is claimed to be a framework consisting of the key dimensions explaining what teamwork is. Five core components of teamwork and three so-called coordinating mechanisms constitute the Big Five model of teamwork. Teamwork requires coordination, and the three supporting and coordinating mechanisms are important in order to work effectively together, and to achieve the optimal value from the core factors. Salas et al. claimed that there are some common features that facilitates teamwork and team performance independent of domain, independent of organisation types and networks, and across various teams, team tasks, and team goals (Salas et al., 2005). The Big Five model of teamwork is supposed to capture all the relevant teamwork features of any team. The components in the Big Five model are as follows (Salas et al., 2005):

The core factors with some key words regarding the contents of the factors.

1. *Team leadership*: Guide and structure experiences to facilitate coordinative and adaptive action to enhance team performance. Monitor internal and external environment to facilitate team adaptability, coordinate and provide skill development opportunities if and when required. Inform regarding expectations, encourage wanted behaviours. Communicate and ensure that the team's shared mental model is understood.

2. *Mutual performance monitoring*: Monitoring fellow team members' work while carrying out one's own work. Ensure everything is going as expected and according to plan, or identify mistakes or lapses.
3. *Backup behaviour*: On the basis of monitoring; detect and recognise uneven workload distribution in the team and any team member who has a work overload, anticipate other team members' needs through accurate knowledge about their responsibilities. Allocation of resources according to the needs at the time to obtain more appropriate workload distribution among members to achieve balance during high periods of workload or pressure, and provide resources and task related efforts as needed. Backup behaviour is also important for adaptability to changing situations and environment. It is proposed that shared mental models and mutual performance are necessary antecedents for effective backup behaviour, as these form the foundation for decisions of when back up behaviour is needed, what kind of assistance is needed, and by whom.
4. *Adaptability*: Recognise deviations from expected action based upon information gathered from the environment, and readjust strategies and actions accordingly through the use of backup behaviour and reallocation of intrateam resources, and if necessary alter course of action or team repertoire in response to internal or external changing conditions.
5. *Team orientation*: A preference for working with others and a tendency to take others' behaviour into account during group interaction to enhance individual performance through the coordination, evaluation, and utilising task inputs from other members while performing group tasks. Emphasis on team goals over individual goals. Higher degree of involvement in task, information sharing, and goal setting.

Team members should have the ability to anticipate and predict each other's needs through common understanding of the environment and expectations of performance. This requires a shared understanding or representation of team goals, individual team member tasks and the coordination of the team to achieve common goals. The following coordinating mechanisms are considered to be necessary facilitators of the Big Five (Salas et. al., 2005):

1. *Shared mental models*: A framework promoting team members' common and shared understanding. Exchange of necessary information useful in order to facilitate the continuous updating of the team's shared mental model.
2. *Mutual trust*: A perceived understanding and acceptance that team members are looking out for each other for the good of the team.

3. *Closed-loop communication*: Involves a sender initiating a message, a receiver receiving the message, interpreting it, and acknowledging the receipt, and the sender following up to make sure that the intended message was received.

The team effectiveness outcome will depend upon how all these factors and coordinating mechanisms are handled in the team. Thus it is important to differentiate between team performance and team effectiveness. Team performance accounts for the outcomes of the team's actions, including the influence of any factors external to the team, which may influence the outcome, and regardless of how the team may have accomplished the task. Team effectiveness, on the other hand, has a different perspective. Both how the team performed, as well as the interaction in the team in order to achieve the team outcome, are considered (Salas et al., 2005).

The different components of the Big Five model are proposed to vary in their importance during the life span of the team and also differ according to the team tasks (Salas et al., 2005). Another fundamental criterion for the model is that the team members must be highly interdependent when it comes to completing the team tasks, and that completing the task without depending upon other team members will not be possible. Hence the Big Five is based upon a high degree of interdependence. The Big Five model proposes some common features regarding the team structure which seem to be important for teamwork and team functioning. The focus is the output of that teamwork, which will appear through team effectiveness. Many researchers have shown that it is the processes in the team that ensure team effectiveness, and Salas and colleagues claims that teamwork is what makes teams successful.

The Development and Maturity of Teams - the Time Perspective

The main topics in Sjøvold's book (2006) about teams are the development, the effectiveness and the change in teams. Sjøvold claims that the team dynamics and the team processes develop and change over time during the life span of the team, and he proposes that the time perspective is important in the development of teams. The team is not a static unit, in the sense that the focus of the team and its team members, and what is considered to be important aspects or issues for the teamwork, could differ over time, across the conditions, and according to the situational demands. Hence various teams have different features, and the aspects which are important for the team functioning could vary depending upon the status of the team at the time. The team's maturity, the team tasks, the context the team operate within, and the challenges they are currently facing may change, and these conditions could be

influential as to which teamwork aspects is more relevant for the team at the time, which also applies for the requirements of the team.

If that is the case, it would support the view that different teams should have diverse Big Five profiles, as the different dimensions of the Big Five of teamwork model should be of various importance and relevance for a team, depending upon the specifics of the team and their situation (Salas et al., 2005; Sjøvold, 2006). It is suggested that teams evolve and develop over time, and a highly developed team is a more effective team (Sjøvold, 2006; West, 2004). Teambuilding activities could be useful for developing teams, team functioning, and effectiveness if the effort is adapted to the particular team and relevant for their team tasks and the context the team operates within. However, developing a team into a too high developmental- or maturity level is wasted if the team task does not demand for the team to function on that level. Consequently the efforts regarding the development of teams should be in accordance with the demands and the needs of the particular team connected to their tasks and the context the team operates within. Achieving more knowledge about the factors that influence the team functioning could be beneficial in order to facilitate more effective teamwork and better performing teams in any organisation.

There have been some objections to the idea of a generic teamwork model applicable for all teams, and it has been argued that the aspects relevant for teamwork should be defined according to the specific features of the team, such as the team task and the team context (Cannon-Bowers et al., 1995; Salas et al., 2000). It is nevertheless of interest to examine how the Big Five model captures the teamwork of different teams in the maritime domain. If there are themes or topics considered relevant for teamwork which are not included in the model, it could imply that specific aspects apply for teams and teamwork in this domain.

The Present Study

Team members' reflections regarding their own teamwork may supply important information regarding aspects relevant for teamwork. The main purpose of the study was to examine and map the reflections on teamwork in teams in a complex organisational network. This in order to investigate how well the Big Five of teamwork model captures these reflections, to unveil any aspects of teamwork the model does not account for, and to examine whether the Big Five components vary across teams from different organisational levels.

A traditional survey approach could have been used. However questions asked in a survey could function as a trigger for the categories it is meant to measure, thereby resulting

in measuring the recognition rather than the recollection (Hoff, Flakke, Larsen, Lone, Bjørkli, & Bjørklund, 2009). Surveys are also more likely to measure only the predefined categories, which may or may not be relevant in the actual context. This can result in missing out on information regarding other aspects which could be relevant. Performing semi-structured interviews with open-ended questions structured in accordance with the SWOT model was therefore considered to be appropriate for the purpose of the study. The approach is considered to promote the reflexivity of the participants (Flick, 2002), encouraging them to talk freely regarding their own personal experiences. This as opposed to questionnaires which may influence the respondents through giving them cues as to what they should focus upon (Hoff et al., 2009). Performing semi-structured interviews this also allows some flexibility and permits additional, relevant follow-up questions to clarify if something is unclear or in order to make the interviewee elaborate further regarding issues he seems to be particularly concerned about during the interview (Payne, 2000). This approach gives the participants the chance to focus upon the topics they find to be relevant independently of the model the research is based upon. Accordingly utilising the interview approach can potentially supply more information than a survey (Hoff et al., 2009).

The primary aim of the SWOT model is to investigate the internal strengths and weaknesses of an organisation's current situation, and the future opportunities and threats in the external environment (Arslan & Er, 2008; Chermack & Kasshanna, 2007; Dyson, 2004). The SWOT model was first introduced as a useful tool in strategic planning (Mintzberg, 1994). Later various versions of the method have been used in connection with organisational development, without deviating much from the original version of the model.

Lately the socalled M-SWOT has been used as a methodological approach in research. The statements are first coded into the SWOT model, and then these statements are further coded into and matched with other already existing research models relevant to the specific topic (Hoff et al., 2009). The reflections from the participants in the study are first fitted into one of the four dimensions of the SWOT model, which is the reason for the choice of the SWOT based interview format. The next step is to extract the identified SWOT statements from the data and score these into one of the categories of the Big Five model. The findings from these analyses will then be further looked into and tested.

The purpose of the study was to examine the Big Five of teamwork model and its ability to capture teamwork aspects. Salas and colleagues (2005) claim that the Big Five model should account for all relevant teamwork aspects in any team, independent of organisation, organisational level and domain. Hence it should be possible to fit all statements

regarding team and teamwork generated through the SWOT based interviews into one of the five core factors or one of the three coordinating mechanisms constituting the eight teamwork components in the Big Five model. Consequently all the statements not captured by the Big Five model, the residual, should be irrelevant for teamwork.

Hypotheses

1. The Big Five model defines common aspects important for effective team performance independent of domain and is claimed to be applicable for all teams on different levels in any organisation. This suggests that the Big Five model will capture the specifics of teamwork of all three teams drawn from different levels in the organisational network. Accordingly it predicts that all statements regarding team and teamwork generated through the SWOT based interviews should be accounted for by the Big Five model.

2. As the Big Five model is a general teamwork model meant to capture all features regarding teamwork, the residual statements not accounted for by the model should be irrelevant for teams and teamwork.

3. The three teams are from different organisational levels; one of the teams is from the blunt end and two teams are from the sharp end of the organisational network. The Big Five model should cover the teamwork of all three teams, however the distribution of statements on the various factors may be different depending upon where in the organisational network the team is placed. Hence it is suggested that the Big Five profile of the three teams will be significantly different and in accordance with the applicable organisational level.

Methods

The Company

The study was conducted in the complex sociotechnical system of a company within the maritime domain. The data was collected through interviewing members of three different teams from various levels of the organisational network. The shipping industry is characterised by rather distinctive and specific features. An organisational network in the maritime industry typically consists of ship owners and ship managers, which can also be referred to as the blunt end. The vessels and the crew on board may be referred to as the sharp end. The sharp end can further be divided into officers and ratings. Teams representing the different organisational levels can be considered to be different team types, with various team tasks, roles and responsibilities. The organisation of the work is different for the teams and the requirements regarding competencies, education and training are different for the members of the three teams according to their roles and tasks.

The three teams in the present study were defined as the Core team, consisting of representatives from two different ship management companies, the Top officers, holding the highest ranks on board the vessels, and the Ratings, holding the lowest ranks on board. The core teams consist of people working in shore based office facilities of ship management companies located in various places around the world and the team members normally have fixed and/or regular business hours. The crew on board a vessel normally consists of 23-25 crew members in total. The officers and the ratings both work and live on board the vessels for an agreed and contracted period of time, normally from 3-4 months for the officers and up to 9-10 months at a time depending upon rank and nationality for the ratings. The working hours for the sharp end teams vary depending upon the requirement of the situation. When sailing in open waters, there are normal and scheduled duties in accordance with the respective ranks assigned to work on the bridge, in the engine room, and on deck connected to various tasks in order to operate the vessel (for example navigation, steering, monitoring, maintenance jobs, and in various ways operating the vessel in order to sail according to plan). At other times, especially during loading and discharging, the working hours and schedules are planned in accordance with the requirements of that particular situation. Worth mentioning is that the team members from the sharp end teams interact with the same people both during working hours and in their free time while they are on board the vessel.

The ship management companies have a pool of Top officers approved by the Company and they have normally worked for the Company over several contracts. The

ratings are employed by a ship management company and may be contracted to work on board ships belonging to various ship owners that the management company are engaged by.

The Sample - the Participants

The study was carried out in a rather complex sociotechnical system, and the total of 39 participants from three different teams represented three different organisational levels. The primary aim was to capture the participants' reflections about team and teamwork in their work environment. The next aim was to yield the reflections of teams at various levels of the organisational network.

Three different teams were defined; The Core team consisted of employees in ship management companies, where the members of the team were dealing with the Company on a day-to-day basis or whenever called for. Representatives from the Core team in two different ship management companies were interviewed, amounting to a total of 16 interviews. The other teams consisted of representatives for the crew on board vessels; a total of 11 interviews were carried through with the Top officers, and 12 interviews were carried through with the Ratings.

All the participants in the study were male, the age was ranging from 23 years old to 61 years old, with an average of 42. As for national origin there were 26 participants from India, 6 from Croatia, 2 from Great Britain, 2 from Pakistan, 1 from China, 1 from Malaysia, and 1 from Russia among the 39 interviewees in total.

Procedure

Interviews. Aiming at obtaining the interviewees' own opinions and reflections regarding team and teamwork in their job environment, interviews were considered to be an appropriate method for our purpose. Through choosing a semi-structured interview format the topics were defined beforehand and questions were formulated in an interview guide (please see Appendix A). A semi-structured interview with open questions should promote reflexivity (Flick, 2002), encouraging the participants to talk frankly and independently regarding their own personal experiences. This as opposed to surveys with predefined alternative response categories which could influence the respondents regarding their answers (Hoff et al., 2009). Semi-structured interviews also allow some flexibility and permit additional, relevant follow-up questions to clarify if something is not clear or in order to make the interviewee elaborate further regarding issues he seems to be particularly concerned about during the interview (Flick, 2002; Payne, 2000).

The interviews were structured according to a SWOT format, with an interview guide containing four main questions based upon the four elements constituting the SWOT model (Arslan & Er, 2008), namely strengths, weaknesses, opportunities, and threats. Utilising the SWOT model one of the aims is to identify the strengths and weaknesses of an organisation's current situation and the opportunities and threats in the future work environment (Arslan & Er, 2008; Chermack & Kasshanna, 2007; Dyson, 2004).

The four main questions were as follows:

"What do you think is positive when it comes to teamwork in your job environment?",
"What do you think is negative when it comes to teamwork in your job environment?",
"How could teamwork be even better?", and
"What kind of problems could prevent teamwork?"

These open-ended questions are inviting the interviewees to reflect upon and describe their own experiences and to talk as freely as possible about these issues in their teams and teamwork (Flick, 2002; Johannessen, Tufte, & Kristoffersen, 2005; Payne, 2000).

The interviews were performed from November 2008 to February 2009. The participants from the two ship management companies, the Core team, were interviewed in their own facilities; one company in Dubai and the other one in Singapore. The interviews with the Top officers were carried through on various premises, partly in the facilities of one of the management companies, partly on board a vessel while on journey, and some in a hotel suite during an officers' conference in Croatia, which was arranged by one of the two management companies participating in the research project. All the participants in the Ratings team were interviewed on board a vessel, and all the members of the Top officers on board that specific vessel were also interviewed. The vessel was operated by one of the two ship management companies involved in the study. In order to get as honest and open reflections as possible it is beneficial to gain understanding for the purpose of the interviews from the participants, and attempt to achieve a certain level of trust connected to the research project (Banister, Burman, Parker, Taylor, & Tindall, 1994; Payne, 2000). The interviewing started on the fifth day on board.

Location. The location of a research interview can be important. Payne (2000) recommends a quiet and private place with no noise, and preferably with no interruptions or as few interruptions as possible from the surroundings. By involving the people in charge of managing the facilities when making the interview schedules this was taken into consideration, and the interviews were carried through in private locations such as a private office, a conference room, a hotel suit, or a spare cabin.

Informed consent. Before starting an interview, the interviewee was asked to read a letter of informed consent (see Appendix B). The informed consent included information about the project, confirmation about the participant's anonymity, that the information obtained in the interview would not be traceable to any specific person and would be treated confidentially, and a confirmation to an agreement to accept tape recording of the interview. The informed consent was then signed by both the interviewer and the interviewee. In order to avoid any misunderstandings regarding the main topic of the interview and to make sure the interviewee should understand the terms used, a note with explanations of the concepts team and teamwork was presented and read by each participant (Salas et al., 1992).

Preparations for interviewing. According to Flick (2002), interview training can contribute to increase the reliability of interview data. A course in communication and interview training were held by professor Roald Bjørklund, Department of Psychology, University of Oslo prior to starting the data collection for the research project. The interviewers were trained in an interview technique in accordance with the PEACE model (Clarke & Milne, 2001; Milne & Bull, 2003). The research interviews were based upon the theory and the practical training which was carried out during that course.

Performing the interview. The interviews were performed one by one and one-to-one, meaning that only one of the two students interviewed one of the participants at a time. This could make a more comfortable and relaxed setting for the interviewees, and it also saved time for the interviewers when that was needed. All the interviews were recorded on audio tape in order to capture everything that was uttered during the interviews as fully and as correctly as possible, and to avoid missing out on any important and relevant information.

Transcriptions. The interview recordings were transcribed fully word-for-word by the same two students who conducted the interviews. The participants' ability to express themselves in English was highly varied and in some cases somewhat difficult to understand. Aiming at the transcriptions to be as correct and precise as possible, these were cross-checked through transcribing parts of the other student's interviews, and no deviations were found.

Analysis

Coding. After having completed transcribing the interviews, the transcriptions were transferred to NVivo 8, which is a computer based program designed for analysing, structuring and quantifying qualitative data. Going through the whole data corpus, all statements related to the participants' experiences with team and teamwork were identified and drawn from the transcriptions to form the data set. These statements were coded

according to the SWOT model, and they were all fitted into one of the four categories strengths, weaknesses, opportunities or threats (Arslan & Er, 2008). The SWOT approach aims at analysing internal and external organisational environment. This includes identifying the strengths and weaknesses of the team and teamwork in the current work environment, while the opportunities and threats involve potential improvements or hindrances which could influence the teamwork in the work environment in the future (Arslan & Er, 2008; Chermack & Kasshanna, 2007; Dyson, 2004). The data set was defined as all the statements regarding teams and teamwork that could be scored into the SWOT model. Any statements not involving teams or teamwork, were excluded as not relevant for the study.

A statement was defined as "The smallest meaningful unit that says something directly, or indirectly, about the interviewees' experiences of team and teamwork in their job environment" (in accordance with Charlsen, 2009; Imset, 2008; Salvesen, 2008; Straumsheim, 2007). It could be part of a sentence, a whole sentence, or several sentences. Some statements were expressed repeatedly during the interview. If the same statement was repeated in the same section of the text, it was only counted once, but if it came up in a different section of the text and in another context, the statement was coded several times. Each statement was coded into only one of the four SWOT categories, which means that a statement coded as strength could not simultaneously be an opportunity.

The next step was to score the SWOT statements into the Big Five model (Salas et al., 2005). This process is referred to as M-SWOT by Hoff et al. (2009), thus each statement should be coded into one of the eight components that constitutes the Big Five model.

Before scoring the statements into the Big Five model, a good overview of the Big Five components, the definitions and the behaviours associated with the five factors and the three coordinating mechanisms was essential (Salas et al., 2005). It is claimed that all statements related to teams and teamwork should be accounted for by the Big Five. Any statements which could not be coded into the model should accordingly be irrelevant for teamwork. Considering the possibility that there could be statements not fitting into the model, it was agreed that any such statements should preliminary be coded into a separate category as *not accounted for* by the Big Five model.

The hypotheses involved the Big Five model of teamwork and the various teams in the organisational network, and the intention was to test these hypotheses based upon the results from the study. Through the decision to perform semi-structured interviews based upon the SWOT model, some contextual frames were already defined while preparing the study, hence

constituting a framework for the analysis process and forming the basis for the primary analyses of the data.

Content Analysis - Thematic Analysis

For further analyses of the residual statements, the statements not covered by the Big Five model, two different approaches were considered. *Thematic analysis* is claimed to be an accessible and theoretically flexible technique for analysing qualitative research data (Braun & Clarke, 2006). *Content analysis* is referred to as a useful research tool for careful examination of textual messages, aiming at summarising and seeking to generate generalisable conclusions rather than reporting detail (Neuendorf, 2002). Krippendorff's definition (2004, p. 18) is as follows: *"Content analysis is a research technique for making valid inferences from text (and meaningful matter) to the contexts of their use."* When the context is considered, and the research is motivated by specific research questions and purposes, the content analysis could be performed relatively efficiently (Krippendorff, 2004). Playing an active role in identifying patterns and themes, making the decisions and selecting which are of interest and reporting them, the researcher should apply a reflexive and critical evaluation during the whole process of analysis (Banister, Burman, Parker, Taylor, & Tindall, 1994; Krippendorf, 2004). Crucial decisions regarding the design for the data analysis was taken during the preparations for the study. The contextual basis for the study was defined through the choice of using semi-structured interviews with questions structured according to the SWOT model, and the decision to address people working in an organisational network in the shipping industry regarding their perceptions of important aspects of their teamwork.

The two techniques have many similarities, but while the Content analysis is based upon quantitative principles, the Thematic analysis is more qualitative in approach. The purpose for analysing the residual statements was to find the contents or meanings of these statements, to identify themes and patterns in the interview data, relating this to the context and fitting the statements into categories according to the theme or topic (Holsti, 1969). As the intention also was to perform statistical analyses of the data, the Content analysis was considered to be a suitable and useful technique.

Interrater reliability. One of the students unfortunately had to postpone the completion of the study due to illness, hence the interrater reliability was not investigated. There will be further comments regarding this under Limitations of the study.

Ethical Considerations

All the interviewees were informed that the participation in the study was voluntary. Before the interview started, the interviewee was requested to read the informed consent note. As mentioned previously, information about the interviewers, the content and the purpose of the study was included in the informed consent. It also confirmed that any information given during the interviews would be treated confidentially, it would not be traceable to any specific person, and the participants were assured complete anonymity. The interviewees were informed that they were entitled to withdraw from participating in the study at any time. Explanation regarding the preference for tape recording the interview was also included. The informed consent form was signed by both the interviewer and the interviewee. It is not likely that the involvement in the research has had any negative effects on the participants.

Statistical Analysis

In order to apply statistical tests, the quantified statements were plotted into SPSS 16.0.

To test hypothesis 1, Chi-Square tests were carried out to compare the total number of SWOT statements generated from the interviews which could be coded into the Big Five model with the residual, the number of statements not accounted for by the model.

To test hypothesis 2, a content analysis of the SWOT statements not accounted for by the Big Five model was performed. The categories and the contents were further investigated to examine the relevance for teamwork.

To test hypothesis 3, ANOVA and post hoc tests, pairwise comparisons and repeated measures, and t-tests were carried out in order to test the components within the Big Five of teamwork model, and to find out whether the teams' Big Five profiles would differ depending upon organisational level.

Results

Descriptive statistics

From the 39 interviews, a total of 1901 SWOT-related statements regarding team and teamwork were identified. The distribution of the statements for the three teams according to the SWOT model was as follows, as per Table 1. The highest number of statements was held by the Core team with a total of 1001 statements (based on 16 interviews), the Top Officers held 600 statements (11 interviews), while the Ratings held 300 statements (12 interviews). As Table 1 shows, all three teams shared a similar distribution pattern for the SWOT

statements, the majority of statements on strengths with a total of 1004 statements - 52.81%, next weaknesses with 475 statements - 24.99%, then opportunities with 266 statements - 14.05%, and finally threats with a total of 155 statements - 8.15%.

Table 1

Distribution of statements in the SWOT Model, by teams

	R		TO		CT		Total	
SWOT	No.	%	No.	%	No.	%	No.	%
S	204	68.00	325	54.17	475	47.45	1004	52.81
W	44	14.67	169	28.17	262	26.17	475	24.99
O	32	10.67	57	9.50	178	17.78	267	14.05
T	20	6.67	49	8.17	86	8.59	155	8.15
Total	300		600		1001		1901	100.00

Note: R = Ratings, TO = Top Officers, CT = Core team, % = Column percent, SWOT = SWOT Model, S = Strengths, W = Weaknesses, O = Opportunities, T = Threats

From the total number of 1901 SWOT statements, 1144 and 60% of the SWOT statements were accounted for by the Big Five model. As per distribution of the three teams (confer Table 2), the Big Five model accounted for 158 (52.67%) of the 300 SWOT statements held by the Ratings, for the Top Officers the Big Five model covered 389 (64.83%) of the 600 SWOT statements, and for the Core team the Big Five model accounted for 597 (59.64%) of the 1001 SWOT statements.

The dispersion of statements on the five factors and the three coordinating mechanisms were not identical across the teams, however the three components in the model holding the major share of the statements were common for all three teams. These three components were *Team orientation*, with the total of 498 statements (26.20%), *Team leadership*, with the total of 395 statements (20.78%), and *Backup behaviour*, with the total of 97 statements (5.10%). The two components holding the highest number of statements scored into the Big Five were *Team orientation* and *Team leadership*. These two held a total of 893 statements, and consequently accounted for 46.98% of all the SWOT statements generated through the interviews and accounted for by the Big Five. Worth mentioning is that only one of the teams, the Core team, held statements involving the coordinating mechanism *Shared mental models*, and then only 3, while the other two teams did not have any statements covering this component.

A total of 757 statements were not covered by the Big Five model and these were initially put into a category labelled as *Not accounted for*. By team these were 142 statements by the Ratings' from their total of 300 SWOT statements (47.33%), 211 statements of 600 statements by the Top Officers (35.17%), and 404 statements of the 1001 SWOT statements

(40.36%) by the Core team. The 404 statements from the Core team accounted for 53.37% of the statements not covered by the Big Five, the 211 statements held by the Top officers accounted for 27.87% and the 142 statements held by the Ratings accounted for 18.76%.

Table 2

Distribution of statements in the Big Five Model and the residual, by teams

	R		TO		CT		Total	
Big Five	No.	%	No.	%	No.	%	No.	%
TL	50	16.67	192	32.00	153	15.28	395	20.78
MPM	12	4.00	6	1.00	12	1.20	30	1.58
BB	24	8.00	25	4.17	48	4.80	97	5.10
A	3	1.00	19	3.17	53	5.29	75	3.95
TOR	63	21.00	124	20.67	311	31.07	498	26.20
SMM	0	0.00	0	0.00	3	0.30	3	0.16
MT	4	1.33	20	3.33	12	1.20	36	1.90
CLC	2	0.67	3	0.50	5	0.50	10	0.53
Sum	158	52.67	389	64.83	597	59.64	1144	60.18
NAF	142	47.33	211	35.17	404	40.36	757	39.82
Total	300		600		1001		1901	100.00

Note: R = Ratings, TO = Top officers, CT = Core team, % = Column percent, Big Five = Big Five model, TL = Team leadership, MPM = Mutual performance monitoring, BB = Backup behaviour, A = Adaptability, TOR = Team orientation, SMM = Shared mental models, MT = Mutual trust, CLC = Closed loop communication, NAF = Not accounted for by the Big Five model (Residual)

Test of Hypotheses

Hypothesis 1. Hypothesis 1 tested to find out to which degree the Big Five for teamwork model accounted for the statements from the teams participating in the study.

From the total of 1901 SWOT statements, 1144 statements and 60% of the total number of team and teamwork statements generated through the interviews with the participants in the study could be scored into the Big Five model.

In order to test hypothesis 1, Chi-Square significance tests were carried out to examine the difference in the frequency data between the teams. The Chi-Square test for the total number of statements held by all the three teams revealed that there was a significant difference between the observed and the expected number of SWOT statements that could be coded into the Big Five model compared to the number of SWOT statements not accounted for by the model: Chi-square=78.38, df=1, p=<.0001, hence a significantly higher number of SWOT statements was accounted for by the Big Five model, than the number of statements not covered by the model.

Further separate Chi-Square tests for the three teams were carried out with the following results; There was a significant difference between the observed and the expected number of SWOT statements that could be coded into the Big Five model compared to the statements not accounted for by the model for the Top officers (chi-square=52.22, *df*=1,

p=.0001), and for the Core team (chi-square=36.82, *df*=1, *p*=<.0001), and for both teams the number of statements accounted for by the Big Five model was considerably higher than the statements not accounted for by the model. For the Ratings there was not a significant difference between the observed and the expected number of SWOT statements that could not be coded into the Big Five model and the statements not accounted for by the model (chi-square=0.76, *df*=1, *p*=<.3833).

Despite the result for the Ratings, the overall meaning of these results indicate that the five core factors and the three coordinating mechanisms of the Big Five of teamwork model account for important teamwork aspects.

Hypothesis 2. From the total of 1901 SWOT statements generated through the SWOT based interviews 757 and 40% of the statements could not be coded into one of the five core factors or one of the three coordinating mechanisms constituting the Big Five model.

In order to examine the message contents of the residual, the statements not accounted for by the Big Five model, and determine the themes or the topics of these statements, a content analysis was performed in accordance with the description in the Method section of this paper (Flick, 2002; Krippendorff, 2004; Kvale, 1996; Neuendorff, 2002). Through a thorough analysis process a total of 11 different categories were identified. All these categories, with the total number of statements scored into each of them, are shown in table 3, by team.

To obtain a clearer picture of the data the analysis was structured on team level, similarly to the procedure that was applied for the statements coded into the Big Five model.

Table 3
The Residual - Statements not accounted for by the Big Five Model - Distribution on categories, by teams

	R		TO		CT		Total	
NAF	No.	%	No.	%	No.	%	No.	%
CCH	0	0.00	3	1.42	24	5.94	27	3.57
COMP	24	16.90	34	16.11	53	13.12	111	14.66
DIV	13	9.15	12	5.69	16	3.96	41	5.42
ENV	15	10.56	24	11.37	13	3.22	52	6.87
EXP	5	3.52	21	9.95	16	3.96	42	5.55
GR-ID	8	5.63	3	1.42	11	2.72	22	2.91
HRM	0	0.00	20	9.48	60	14.85	80	10.57
IND	18	12.68	19	9.00	47	11.63	84	11.10
INTER	18	12.68	29	13.74	75	18.56	122	16.12
PERS/W	13	9.15	11	5.21	3	0.74	27	3.57
STRUC	28	19.72	35	16.59	86	21.29	149	19.68
Total	142		211		404		757	100.02

Note: R = Ratings, TO = Top Officers, CT = Core team, % = Column percent, NAF = Not accounted for
CCH = Communication channel, COMP = Competencies, DIV = Diversity, ENV = Environment-Climate, EXP = Experience, GR-ID = Group identity, HRM = Human resources management, IND = Individual characteristics, INTER = Interactions - relations, PERS/W = Personal life vs. work life, STRUC = Structure

In table 4 below, there is a list of the categories made on the basis of the content analysis of the statements not accounted for by the Big Five model, with a short explanation of the contents of each category, how many statements that were coded into each category, and the teams with statements coded into the category. Further below are short explanations of the contents of each category. For more fulfilling information regarding the categories, please see Appendix C for further definitions and explanations of the contents and the meanings, what each of them involves, the themes and the topics which are included. The sources for references are noted in Appendix C. In Appendix D, there is further information regarding these categories, including the relevance and the significance of these aspects for teamwork in the maritime domain. A few example statements for each category is also included.

Table 4

The Residual - Statements not accounted for by the Big Five Model - Categories and content

Category	Content/Meaning	Rel	No. of Statements	Team repr.
Communication channel	Availability, functioning, quality of comm systems/equipment for team communication	Yes	27	Top off Core team
Competencies	Knowledge, skills, ability to compl. tasks, handle challenges. Learning, training. Development, improvement.	Yes	111	Ratings Top off Core team
Diversity	All types of diversity, incl cultural, national, ethnic, race, religion, value, belief. Language.	Yes	41	Ratings Top off Core team
Environment - climate	The social norms and shared ideas for how things are done; Acceptance for speaking up, acceptable behaviour.	Yes	52	Ratings Top off Core team
Experience	Knowledge, skills, abilities + sufficient time to practice profession, acquire understanding for relevant prof. challenges.	Yes	42	Ratings Top off Core team
Group identity	Sense of attachment and belonging to the team/org/org network, consequently commitment, loyalty.	Yes	22	Ratings Top off Core team
Human res management	Planning, use and allocation of personnel. Selection/ recruitment/turnover/retention.	Yes	80	Top off Core team
Individual characteristics	Individual and personal characteristics, attributes and attitudes.	Yes	84	Ratings Top off Core team
Interaction - relations	The complex interplay between individuals, groups, org. and work. Interpers. rel. in the team.	Yes	122	Ratings Top off Core team
Personal life vs work life	The personal life - work interface. The balance between work hours and the need for personal space.	Yes	27	Ratings Top off Core team
Structure	Structural frames and context which influence the functioning of the team. Rules, regulations, resources, demands, goals.	Yes	149	Ratings Top off Core team
Total			757	

Note: Category = Label/theme according to the contents of the statements coded into the category, Content = What meanings/topics the category include, Rel = Relevant for teamwork, No. Statements = Number of statements regarding this category/theme generated through the interviews, Team repr = Team with statements coded in this category

1. *Communication channel*

Availability, functioning and quality of communication equipment and systems such as walkie talkies and email system which can facilitate or hamper communication among team members and members or the organisational network involved in the various operations, either they are on different locations on board a vessel, ship to shore, or only on shore.

2. *Competencies*

Issues in connection with knowledge, skills and ability to complete tasks and handle challenges. Learning, training, development, and improvement are also included.

3. *Diversity*

All types of diversity, including cultural, national, ethnic, race, religion, value, belief. Language.

4. *Environment - climate*

The social norms and shared ideas for how things are done; Acceptance of, approval of and possibilities for discussing and speaking up. The normal way of handling various issues in the work environment. What kind of feelings, thoughts and behaviours are acceptable and approved of when people relate to each other.

5. *Experience*

Appropriate competencies, knowledge, skills, and abilities, and sufficient time practising the profession to acquire a higher level of understanding in order to be able to handle more complex and relevant professional challenges.

6. *Group identity*

Sense of emotional attachment and belonging to the team, organisation and/or organisational network, a normative commitment and loyalty towards the team, towards other members of the team, the organisation, and the organisational network.

7. *Human resources management*

Issues related to manpower; Planning, use, and allocation of personnel. Selection and recruitment, turnover and retention.

8. *Individual characteristics*

Individual or personal characteristics, attributes and attitudes of individuals.

9. *Interactions - relations*

The complex interplay between individuals, groups, organisation and work. Interpersonal relations in the team, giving and receiving feedback, appreciation, blame, social support, socialising.

10. *Personal life versus work life*

The interface between personal life and work life. This may be complicated enough for a shore based team having to be available at all times if anything should happen with something they are responsible for. The balance between work hours and the need of personal time and space may be even more complicated for the team members on board a vessel, where the people both live and work in the same environment 24/7 for months at a time. The respect for and the understanding for the need of some personal life or privacy may be challenging sometimes, especially at times of loading and discharging.

11. *Structure*

Structural context and frames, rules and regulations in the organisational network, in the industry and environmental considerations, which could influence the functioning of the teams. Diverse requirements, demands, goals, crew change, length of contract. Role and task definitions, hierarchy. Allocation of resources; financial and other resources, such as various types of facilities, tools and equipment.

Three of the categories, *Competencies*, *Interaction - relations* and *Structure* accounted for more than 50% of the SWOT statements not covered by the Big Five. Two of the categories; *Communication channel* and *Human resources management*, held statements from only two of the teams, the Top Officers and the Core team, and no statements from the Ratings, while the rest of the categories held statements from all the three teams.

Hypothesis 2 was tested to see whether the residual, the statements not accounted for by the Big Five model, contained information irrelevant for teamwork, as was predicted by Salas and colleagues (2005). Content analysis and close considerations evaluating the contents and the meanings of the statements while searching for themes, topics, and categories, revealed that the statements not accounted for by the Big Five model involved relevant aspects for teamwork in these teams and in this domain.

Hypothesis 3. Hypothesis 3 predicts that the number of statements coded into the different components of the Big Five model should vary to some extent for the three teams, and that the pattern for the dispersion of statements on the five factors and the three coordinating mechanisms is not identical across the teams. All the three teams shared the same two components holding the major share of the statements. *Team orientation* held the most statements (498/26%) in total and was considered the most important or the second most important Big Five category for teamwork by all the three teams. *Team leadership* was the category with second most statements (395/21%) in total, and also considered most important

or second most important by all the three teams. Further *Backup behaviour*, with a total of 97 statements (5%) and *Adaptability*, with 75 statements (4%) also appeared to be considered as relevant for teamwork by the three teams. Worth mentioning is that only one of the teams, the Core team, held statements involving the coordinating mechanism Shared mental models and then only 3, while the two other teams did not have any statements covering this component.

To test hypothesis 3, ANOVA and post hoc tests were performed to examine whether there is a difference internally between the components within the Big Five model, and significant differences within the model were revealed (Sums of squares 6080.875, *df*=7, *F*=5.106, *p*=<.001). Hence the next step in order to test hypothesis 3 was to perform pairwise *t*-tests and repeated measures for comparing the components of the Big Five model by team. These analyses revealed the following;

A limited number of statements were coded into the two dimensions *Shared mental models* and *Closed loop communication*. Further testing was therefore not considered to be worthwhile, as any significant differences would not supply any meaningful information due to the limited number of statements.

There were also rather few statements coded into the aspects *Mutual performance monitoring* and *Mutual trust*, nevertheless sufficient to make it worth looking further into comparing the teams regarding these two components. Please observe the limited number of statements coded on these dimensions.

As for the category *Team leadership* the number of statements from the Top officers (*M*=17.45, SD=6.378) was significantly higher(*t*=6.074, *df*=15.53, two-tailed, *p*=<.001) than the number of statements held by the Ratings (*M*=4.17, SD=3.614). The number of statements coded on *Team leadership* for the Core team (*M*=9.56, SD=7.492) was also significantly higher (*t*=6.074, *df*=15.53, two-tailed, *p*=<.001) than that of the Ratings team (*M*=4.17, SD=3.614). There was no significant difference (*t*=2.851, *df*=25, *p*=.569) regarding the number of statements on this factor between the Top officers and the Core team.

For the component *Mutual performance monitoring* there were no significant differences between any of the teams. There was however a rather small number of statements on this category with merely 12 statements each from the Ratings and the Core team, 6 statements from the Top officers, and 30 statements in total.

For *Backup behaviour* there was no significant difference between any of the teams.

For *Adaptability* there was a significant difference between all the three teams. The number of statements from the Top Officers coded on *Adaptability* (*M*=1.73, SD=1.555) was significantly higher (*t*=3.035, *df*=11.548, two-tailed, *p*=.011) than the number of

statements held by the Ratings (*M*= .25, SD=.452). The number of statements held by the Core team coded on this category (*M*=3.31, SD=2.845) was significantly higher (*t*=4.235, *df*=16.003, two-tailed, *p*=.001) than that of the Ratings team (*M*=.25, SD=.452). Finally the number of statements from the Core team coded on *Adaptability* (*M*=3.31, SD=2.845) was significantly higher (*t*=1.861, *df*=24.055, two-tailed, *p*=.075) than the number of statements held by the Top officers (*M*=1.73, SD=1.555).

For the Big Five component *Team orientation* there was a significant difference (*t*=7.073, *df*=20.720, two-tailed, *p*=<.001) between the Core team (*M*=19.44, SD=7.294) and the Ratings team (*M*= 5.25, SD=2.896). No significant difference was observed between the other teams.

For the category *Mutual trust* there was a significant difference (*t*=2.379, *df*=13.943, two-tailed, *p*=.0323) between the Top officers (*M*= 1.82, SD=1.888) and the Ratings (*M*= .33, SD=.888), and the Top officers held a higher number of statements. There was also a significant difference (*t*=1.861, *df*=24.055, two-tailed, *p*=.075) between the Top officers (*M*= 1.82, SD=1.888) and the Core team (*M*= .75, SD=.856), with the Top officers holding a significantly higher number of statements than the Core team. No significant difference between the Ratings (*M*= .33, SD= .888) and the Core team (*M*= .75, SD=.856). It is however worth noticing that the number of statements on this dimension is relatively limited.

The results from the pairwise comparisons using t-tests and repeated measures showed that there were significant differences regarding the emphasis on the various Big Five categories between the three teams.

The pairwise *t*-tests and repeated measures that were performed comparing the three teams' emphasis of the different Big Five components, showed that at least two of the teams from various organisational levels had a somewhat different distribution regarding four of the Big Five dimensions; namely *Team leadership*, *Adaptability*, *Team orientation*, and *Mutual trust*. There was no significant difference between any of the teams on *Mutual performance monitoring* and *Backup behaviour*. The aspects *Shared mental models* and *Closed loop communication* were not tested due to few statements coded on these components. These findings are in accordance with the prediction of hypothesis 3.

Discussion

The SWOT based interviews generated a considerable amount of information regarding the teams and their teamwork in this complex organisational network. The main findings of the study were the following:

Statements

SWOT. The interviews yielded a total number of 1901 statements regarding team and teamwork. All the statements were fitted into the SWOT model; 1004 statements related to strengths, 475 related to weaknesses, 267 related to opportunities and 155 related to threats. Accordingly the participants seemed to be more focused upon the positive aspects and the present situation of their teamwork, than on the negative sides and future conditions.

The Big Five of teamwork model. From the total number of SWOT statements the Big Five accounted for 1144 (60%) of the statements generated from the interviews, which was a significantly higher number of statements than the residual, the statements not covered by the Big Five model. Three of the components of the model, *Team orientation*, *Team leadership*, and *Backup behaviour*, held almost 87% of the statements that were fitted into the model. Other dimensions were represented by a limited number of statements, for example the coordinating mechanism *Shared mental models*, which held merely 3 statements and from only one of the teams.

The residual. There were 757 statements not accounted for by the Big Five model. The meanings and themes of these statements were examined through content analysis, which resulted in 11 different categories. The analysis furthermore revealed that the residual statements were relevant for the teamwork in this organisational network and in this domain.

Big Five profile by team. It was anticipated that the Big Five profile would differ, as teams on various organisational levels would put more or less emphasis on the various aspects of their teamwork depending upon team task and according to their own experiences regarding teamwork. Results from further analyses showed different patterns for the three teams when it comes to the distribution of statements on the various Big Five categories.

Hypotheses

Hypothesis 1. The aim of this hypothesis was to test the Big Five of teamwork model's ability to capture teamwork, and 60% of the statements yielded in the SWOT interviews could be coded into the model. Analyses showed that the Big Five model accounted for a significantly

higher number of statements than the residual. As for the different teams tests revealed that the Big Five model accounted for a significant higher number of statements accounted for by the Big Five of teamwork model for two of the teams, the Top officers and the Core team, while there was no significant difference between the observed and the expected number of SWOT statements that could be coded into the Big Five model compared to the number of SWOT statements not accounted for by the model for the Ratings.

There were statements coded into all the Big Five components, however few statements on some of the aspects. Although the findings showed that the model accounted for a significantly higher number of statements than the residual, it could nevertheless be an opportune question to ask whether 60% coverage of teamwork is sufficient and satisfactory to claim that the Big Five model fully accounts for all the aspects of teamwork in all contexts. As there is no clear consensus regarding the quantitative measures of the qualitative contents of the statements, it is difficult to determine how well the Big Five model describes the teamwork, and how appropriate the model is in the planning and performing of teamwork in all contexts. It is therefore impossible to conclude either way based upon the findings in this study. The overall meaning of these results is that the five core factors and the three coordinating mechanisms of the Big Five of teamwork model account for the most important and relevant aspects of teamwork. These results support hypothesis 1.

Hypothesis 2. A content analysis was performed for the residual, the SWOT statements not accounted for by the Big Five model. This implied that the statements could be connected to 11 different themes or categories. Through further analysis of the contents and the meanings of the statements and the themes and topics they involved, these are considered to be relevant for teams and teamwork in this domain. Some of these statements and categories involve internal conditions in the team and are related to aspects that could to various degrees and in different ways be influenced by the team and the team members themselves. Other categories are related to aspects which under normal circumstances cannot be much affected by the team and the team members themselves, as these are most likely directed and regulated by external sources. These aspects may nevertheless still be highly relevant and important for the teamwork functioning. The SWOT statements not covered by the Big Five model was found to constitute a meaningful residual, and consequently hypothesis 2 was not supported by the findings in this study.

Hypothesis 3. By testing the Big Five model utilising ANOVA and post hoc tests, a significant difference between the components within the Big Five model internally was unveiled. Through performing *t*-tests and repeated measures making pairwise comparisons for

all the aspects of the Big Five model by team, significant differences were found regarding five of the Big Five components, including the two aspects *Team orientation* and *Team leadership* holding 78% of the statements. For the Core team, *Team orientation* is beyond compare considered the most important dimension for teamwork, *Team leadership* was also considered important. *Adaptability* and *Backup behaviour* were also perceived as relevant for teamwork by the Core team according to the number of statements coded into the Big Five model. The Top officers perceived *Team leadership* the most important in their teamwork, but also *Team orientation* was considered to be important. *Backup behaviour*, *Mutual trust* and *Adaptability* were found to be approximately equally relevant for their teamwork judging by the number of statements from the Top officers coded on these components. The most important aspects for teamwork for the Ratings was also *Team orientation* and *Team leadership*. In addition to these two, the Ratings also found *Backup behaviour* to be important in their teamwork. As for *Shared mental models* and *Closed loop communication*, there were so few statements coded into these dimensions that these were not actualised as relevant for these teams' teamwork and no further analysis were made.

These findings imply that teams representing various levels of the organisational network perceive different aspects to be important and/or relevant for their teamwork. Consequently the Big Five profile differs depending upon organisational level. These findings support hypothesis 3.

General Discussion

The Big Five of Teamwork Model

The primary aim of the study was to examine whether the Big Five model captures all the relevant aspects of teamwork independent of team type, organisational level and domain, and therefore is applicable for all teams, as claimed by Salas and colleagues (2005). If that is the case, the Big Five model would make other teamwork models redundant, as it would represent a global measure for teamwork and one model would cover teamwork aspects for all types of teams.

The Big Five model was tested as a whole and across three different teams from various levels of the organisational network in a complex system. The model covered 60% of the SWOT statements generated through the interviews in the study, and accounted for a statistically higher number of statements than the statements not covered by the model. Hence

the Big Five captured the basic aspects of teamwork for teams in this organisational network as a whole, and also for two of the three teams from different organisational levels.

A certain understanding of the Big Five model, the basis for the model, the definitions of the various components, and the behaviours associated with the different aspects was essential for performing the study. When something was unclear and difficult to relate to, interpretations had to be made and these understandings and assumptions formed the basis for the further process.

The Big Five model is based upon a high degree of interdependence between the team members, underlining the dependency of each team member's contribution in order to complete the task. As for the teams in the study, some of their tasks may not be real team tasks in that sense. While a high interdependency is applicable for some of their tasks, other tasks may be performed separately by individual members of the team, independently of other team members' contribution. The teams are involved both in collaborative and coordination tasks (Salas et al., 2005), the first one requiring team members to cooperate throughout all the stages of the task, while other tasks are accomplished sequentially. Consequently these teams are not fully in accordance with the interdependency precondition for all their team tasks.

Before coding the SWOT statements into the Big Five model the definitions and the contents of the components of the model had to be clarified. When going through the various dimensions of the model, the initial impression was that all the components primarily seem to be work focused and task related. The individual team member only appears to be considered in connection with the work related behaviour, and as far as any input and contribution to the actual team task is concerned. Any consideration connected to the individual team member which is not directly work related or relevant for the team task does not appear to be part of any of the Big Five aspects. Nor do issues regarding the affective side (Sjøvold, 2006) of the team members' interaction seem to be an element included in any of the dimensions in the model. Although the main focus is the work and the task, the individual team members should nevertheless be seen, heard, acknowledged, and approved of as individuals, and not only as team members. This may be important for the motivation and the obligation to work for the best on the team, and it could influence the performance, the accomplishment of the task, and goal attainment. This may be more relevant for members of the sharp end teams, who are surrounded by their team members both during working hours and when they are off duty. The same goes for the interaction among the team members (Gudelj, Krcum, & Krcum, 2008), which again may be especially evident in the context of the sharp end teams, whose members have to relate to each other 24/7, also during their free time (Håvold, 2005; Østreng,

2007). All the aspects related to the personal interaction, individual approach, and more affective aspects, such as social support, could be of vital importance for the functioning of the sharp end team members (Sjøvold, 2006; West, 2004). Interaction between the team members which is not task- and/or work related, does not seem to be a part of any of the Big Five dimensions.

The Big Five model may be more suitable for already established and stable teams, as issues connected to recruitment, selection, and turnover of team members do not seem to be a part of any of the components in the model. However these aspects are probably both relevant and important for many teams (Sundstrom, 1999; West, 2004), and also appear to be relevant for the teams in this study. The availability of capable personnel is an ongoing challenge in the industry and there is a shortage of experienced seafarers, particularly officers, so there may be some competition in trying to get the best people and make them stay with the company. It is not evident that any individual will be suited for a life and work on board a ship, considering the particular environment that seafarers are exposed to (Håvold, 2005).

There is no mention of any internal and external frames, or any rules of conduct, that the team members should relate to and operate according to. The maritime domain is highly regulated, with many structuring elements constituting a framework for all the teams involved (Rasmussen, 1990). This includes rules and regulations applicable for the whole industry, structural frames set within the complex system, and frames made in the organisational network such as operational procedures and budgets, and the hierarchical organisation on board the vessels with clearly defined roles and responsibilities (Håvold, 2005).

As for the different components of the Big Five model, some of the aspects are specific and clearly defined, and easy to understand and relate to (e.g. the dimensions *Mutual trust* and *Closed loop communication*). The fact that merely 3 statements were coded into *Closed loop communication*, all three from only one of the teams, could reflect that this aspect is relatively narrow in its definition. For these components the risk of making coding mistakes is not very likely. For other components of the model, the definitions are relatively wide. A major share of the statements coded into the Big Five model, were coded into the aspects *Team orientation* and *Team leadership*. The definitions of these categories are rather general and extensive, containing a large number of various elements, dispositions and behaviours compared to the other categories, and a wide range of aspects could be interpreted to fit into these dimensions. Coding all statements with a slight similarity with any of the elements of these components into that aspect, there is a risk for ending up with an accumulation category including a variety of elements more or less according to the definition of the category.

Therefore it was necessary to make limitations regarding the definitions and the criteria of these components. If this had not been done, it could eventually have resulted in inconsistency for the contents within the category. It was perceived as important to be consistent and in accordance with the primary and pronounced qualities of the category, and see it in connection with the other dimensions of the model. As already mentioned, the model's task- and work related focus seems to be of vital importance, and it puts some limitations as to what should be included in the category. In the coding process it proved to be important that these limitations or frames were set beforehand, with the aim to identify a connection to one of the components of the Big Five for all of the SWOT statements generated from the interviews.

Looking deeper into the model, there are some overlaps between the components in the Big Five model which could make it more difficult to determine which is what. When one or more of the aspects are antecedents or precursors at the basis for or condition for other components of the model, or some aspects are mutually influencing one another to varying extents, considering this could potentially lead to confusion and could complicate the picture even further. Having made the interpretations and limitations, it was however easier to concentrate on the essence and the meaning that had been attached to the various categories or statements and relate to that, and coding each statement accordingly into only one of the aspects or as not accounted for by the big Five model. The interpretations and limitations that were made may however also have resulted in a faulty understanding of the Big Five component, hence coding statements which should have been coded into the model as not accounted for.

As for the findings in the study, the difference between the Big Five components was evident, with a relatively high number of statements coded into some of the aspects, and very few on other aspects. One of the reasons for this could be the wide definitions including many elements for some of the aspects (e.g. *Team orientation*), compared to the more narrow and specific definitions of other aspects (e.g. *Closed loop communication*) (Salas et al., 2005). These findings could also imply that the relative importance of each of the components of the model varies, and some aspects seem to be more important than others. Thus a discrimination between the importance of the components of the model could prove to be appropriate.

There were also differences between the three teams regarding the emphasis they put on the various Big Five factors or coordinating mechanisms. The way the Big Five model appears at the moment, it does not propose that there is any difference regarding the importance of the different components of the model, but puts forward the five core factors and the three coordinating mechanisms as equally important to teamwork (Salas et al., 2005).

It was not determined any difference in importance between the components, unequal emphasis or any other corrections regarding the statements and/or categories in the study. If any such corrections had been made and attached to the different categories or statements, it could have been possible to infer meanings or draw conclusions. As this was not done, it is however difficult to determine whether the findings of the study only apply for the sample represented in this research. If that is not the case, it would be suitable to ask whether there are some relevant and important teamwork aspects lacking in the Big Five before it can be claimed to be an appropriate global measure for teamwork.

From the three statements coded into *Closed loop communication*, none of them were from the sharp end teams. However the use of this way of communicating is common on board the vessels, and in certain contexts and situations it is part of the procedures. This draws the attention to the fact that the statements generated through the interviews do not necessarily give the correct picture of how the teamwork functions in these teams, rather which aspects of their teamwork are readily in the minds of the participants at the time of the interviews.

As was predicted, there was somewhat deviating patterns for the three different teams regarding their Big Five profile (Salas et al., 2005). The three components of the model holding the major share of the statements were consistent for all three teams, however the number of statements by each team even on these aspects were highly different. These findings seem to imply that teams representing various levels of the organisational network perceive different aspects to be important and/or relevant for their teamwork. The unequal emphasis on the different elements of teamwork could reflect the various requirements to the teamwork connected to the team tasks. It could imply that the team task, the type of work, the role and responsibility of the team member influence which aspects they perceive to be important for their teamwork, which is in accordance with the view of team- and task specific features (Cannon-Bowers, Salas, & Converse, 1993; Salas et al., 2000; Sjøvold, 2006).

The findings could also indicate that the organisational level can be of importance for the reflections. The total number of statements held by the Ratings were considerably lower than the number of statements held by the two other teams. This could imply that there is a difference between the level of reflection for team members on various organisational levels. As mentioned above, there were differences in the emphasis on the different Big Five components by the teams, which also could be due to the level of reflection. Drawing any conclusions based upon these findings regarding any connection between the level of reflection and the organisational level, would be somewhat premature. The reason for the differences in reflections, as seen from the total number of statements from the teams and the

difference in emphasis put on the various components of the Big Five model, could also be seen in connection with the team task, their roles, and the responsibilities of the team members in the teams (Cannon-Bowers et al., 1993). Investigating this has not been an issue in this study, so it is difficult to say something specific about it. It is however not necessarily the case that the team members in the study do not find other aspects relevant or important for their teamwork, even if they did not come up with any statements regarding that issue in the interview. This can merely be an indication that something else, some other experiences and reflections, were more readily in mind at the time of expressing their opinions and referring to experiences from their own teamwork. It could also mean that some of these aspects are such typical features of their teamwork that they did not come to think of them as something worth mentioning. General mental models appear to be common in the seafaring profession (Aubert & Arner, 1962), and the fact that many aspects of the life and the work on board a ship are considered as natural and obvious parts of the existence, supports that notion.

Several theories and models as to how teams and teamwork emerges, functions and develops have been proposed over the years. Some of the theories have focused on specific team types: leadership teams, task teams, project teams etc. (Bang, 2008; Sjøvold, 2006), while others have been more general in the approach (Salas et al., 2005). The Big Five of teamwork model was introduced as a general model for teamwork, and is claimed to be applicable for all types of teams, at all organisational levels, and in all domains. At the same time some professionals, organisations, and industries have moved in the opposite direction, towards more focused and specialised knowledge and skills, specific functions and division of tasks (Sundstrom, 1999). Consequently an appropriate question could be whether it is possible to find a “one fits all” teamwork model in highly diverse work environments, with different team tasks, functions, and purposes. The components of the Big Five model seem to be relevant for teamwork. However various teams have to relate to their particular context (Håvold, 2005), and specific features and demands according to their tasks and purposes may also be important (Kay, Maisonneuve, Yacek, & Reimann, 2006, Sjøvold, 2006). The context and the environment for the teams in the study, especially the sharp end teams, could be perceived as involving particular demands on the team members of the different teams. The somewhat different emphasis on the various components of the Big Five model is thus understandable. When it comes to the residual, the statements not accounted for by the Big Five model, the team members from the different teams seemed to put different emphasis even on these categories, possibly in accordance with their team task, different roles and/or responsibilities.

The Residual - the Statements not accounted for by the Big Five Model

From all the 1901 SWOT statements 757 statements were not accounted for by the Big Five model. The model predicts that these statements should not be relevant for teamwork (Salas et al., 2005). However performing a content analysis of the residual statements, looking further into the contents and meanings of the statements, placing them into categories according to the themes and the topics they were related to, it was clear that these had relevance for the teamwork in these teams. Although the findings showed that the Big Five model accounted for a significant higher number of statements than the residual, the statements not covered by the model should nevertheless not be left disregarded, as these amounted to 40% of the statements regarding teamwork from the participants in the study. This could imply that the Big Five model is too general, and in its aim to cover the teamwork of all teams, independent of organisational level and across domains, misses out on some aspects that could be important for teams in specific contexts and/or domains. This is consistent with other findings from studies involving the Big Five model (Kay et al., 2006).

As was revealed through performing content analysis of the residual statements, these involved relevant aspects for the teamwork of these teams. The 11 categories proposed to cover the statements included a variety of aspects that are considered to affect the functioning of the teams and their teamwork. Some of the aspects are mostly related to the internal conditions, and could be influenced by the team members and by the team itself, while other aspects are primarily connected to external factors, hence the team members do not have a great deal of influence on these. It could still be useful and even important to take these factors into consideration when designing teams.

For the teams in this study, the concern regarding topics such as *Competencies* and *Experience* could be connected to the fact that the people on board the ships should have all the necessary knowledge and skills in order to handle all possible challenges and situations they could be facing (Chauvin, Clostermann, & Hoc, 2009; Håvold, 2005; Norros, & Nuutinen, 2009). The concern for these topics could also be due to the fact that there is a general shortage of seafarers, and officers in particular. Consequently there is some concern regarding the recruitment of well educated and skilful professionals with sufficient experience to handle complex challenges. In this picture, the issues connected to the management of the *Human resources* becomes relevant. The Core team is also affected by these aspects, as members of the team are involved in the manning of the vessels, and would have to deal with any potential consequences of the seafarers' lacking competencies and/or experience. Also the need for general interpersonal skills and competencies in interaction with others, as in

Interaction - relations, seem to be important (Argyris, 1990; Østreng, 2007), especially in the environment of the sharp end teams, where the people have to relate to each other 24/7, and both professionally and personally (Gudelj et al., 2008). *Individual characteristics* may also influence the interaction, and the interaction during the time off work may affect the interaction during the working hours and vice versa. The participants in the study were also concerned about the *Structure*, and how the aspects connected to the system and the structural frames influence their teamwork (Håvold, 2005; Perrow, 1999). This topic appear to be particularly important for the sharp end teams due to their particular environment, but is relevant for the members of the Core team as well, as some of the issues connected to the structural frames apply equally for the blunt end teams also. According to Sundstrom (1999) the need for different types of structural elements varies with team type. The changing crew is part of this category, hence it may also have relevance for the development and the maturity of the teams on board the vessels (Sjøvold, 2006). The team members of the sharp end teams have to relate to the changing team members as a normal and ongoing part of the team processes, the presence of a certain proportion of newcomers at any moment is one of the characteristics on board a vessel (Håvold, 2005). Some of the team members of some of the teams may work together for a relatively long period of time, while others get to work together for only a short time, maybe just a week or two, before one of them has completed his contract, his reliever signs on and gets on board to replace the former team member. The crew rotation and the continuous change of team members may influence the teamwork functioning for these teams.

As for the interface *Personal life versus work life*, this could represent some extra challenges for the members of the sharp end teams, who have to relate to each other both at work and in their free time (Arnold, 2005; Østreng, 2007). It is reason to believe that many of these aspects are team specific features, and at least more relevant for these specific teams due to their particular context and situation than would be the case for other teams in other contexts. Hence there may be features about the maritime domain, which could add some extra dimensions and demands to the teamwork in these teams. This in accordance with the notion that some factors may apply and be particular for specific teams and specific tasks as opposed to the generic factors applicable independent of task and team type (Cannon-Bowers et al., 1995; Salas et al., 2000). Whether this is the case remains to be seen.

Issues connected to *Communication channels* could be relevant for any team, but may be more important for teams in this type of context, with team members in various locations. A well functioning communication between the teams on board the vessel and the people

ashore may be of vital importance for clearing out challenges that may lead to potentially dangerous situations, and it is obviously crucial in case of any emergencies. The *Diversity* connected to language barriers and cultural issues in this truly international industry may imply some challenges in the teamwork, and the environment for the sharp end teams may be more demanding for the team members. Creating positive elements in the *Environment* could be essential in motivating people to continuous effort in their work. Tasty food, training facilities and social activities could contribute to a heightened sense of *Group identity* for the team members.

For further information, definitions and relevance for the teamwork in these teams regarding the residual statements and the categories, please see Appendix C and Appendix D.

Limitations of the study

Interviews. There are both advantages and disadvantages utilising interviews as a research method. The sample consisted of informants from various backgrounds, from different levels of the organisational network in a complex system, and their knowledge of the English language were on highly different levels. It was anticipated that an interview approach would be more appropriate due to the flexibility of the research method, given the possibility to explain along the way if something was unclear or not understood by the interviewee. This anticipation was confirmed as several of the participants from all the teams took the opportunity to ask questions about the research topic and the meanings of the questions during the interview. The flexibility of the interview approach was also considered suitable for the purpose of the study as it allows the interviewee to talk freely about the topics he finds to be relevant (Payne, 2002). When performing interviews, there is however a risk that the interviewer could influence the interviewee both through wording, the follow-up questions asked, through body language and in various other ways. When different people perform interviews for the same study it may result in a somewhat different focus, thus to some extent obtaining different kinds of information from the interviewees. This due to different ways of interviewing and other individual characteristics of the interviewer. To some extent the interviewers posed different follow-up questions in the research. However these were also dependant upon the information already given by the interviewees, and therefore bound to be in accordance with the context.

The interview as a research method implies the risk of not obtaining honest opinions from the participants. In this study the topic for the interview and the questions were not considered sensitive per se. When sitting face to face with the interviewer, the interviewee

may however find the situation to be too personal and may respond in a way that feels more acceptable (Rattleff, 1992). If this makes the participants reluctant to talk freely and share their experiences as they are, it may jeopardise the possibility of getting honest opinions.

The fact that all the arrangements in order to perform the research were handled by the Company involves a risk that the participants may perceive the interviewers as representatives of the Company. Consequently the way the interviewees respond during the interviews could be affected, as they could get hesitant regarding expressing their true and honest opinions.

The potential disadvantages or weaknesses by choosing interviews as the research method were considered and several precautions were taken (please see the Method section of this paper) in order to avoid some of the possible unfortunate consequences by interviewing.

The sample. Obtaining a random sample from all the three organisational levels including the Ratings, the Top officers, and the Core team appeared to be a challenge and was literally impossible due to the need for careful planning and coordination. This was particularly the case for the availability of the sharp end participants, hence the samples consist of the team members who were available and accessible at the time.

The size of the sample could influence the results, and it is always relevant to ask whether the number of participants is sufficient. The total of 39 participants is a considerable number when collecting research data through performing interviews. When the relevant statements are extracted from the data and quantified in order to perform statistical analyses, a sample of 39 does not appear to be a big sample. Relatively small samples require considerable differences to get significant differences (statistical power). Another issue to consider is whether larger samples would have changed the pattern of the findings to such a degree that it would influence the results extensively. The pattern in the data set is clear, and the findings are considered to be applicable, but it should be noted that a larger sample could possibly have supplied even more relevant information than what was obtained in the study.

The participants in the study were from different national origins, from various levels of the organisational network, and their knowledge of both written and verbal English were on highly different levels. There was a risk that language barriers could cause misunderstandings regarding the meaning of the questions, which could influence the results accordingly. Performing interviews allowing questions from the interviewees could to some extent prevent such misinterpretations.

As mentioned above, the complexity of the system involves a variety of nationalities and cultures, of which the samples in the study contained one possible composition. If the samples had participants representing other countries and cultures, the results could have

differed compared to the findings presented in this paper. The present study nevertheless gives an impression of how seafarers and other employees in the shipping industry look upon their teamwork and supply illustrating examples of their reflections regarding this topic.

The team members of the teams from the various levels of the organisational network have different attachment to the organisation. The Core team members have what could be considered normal employment contracts for office staff of the country in which they are employed. As for the Top officers, the management companies have a pool of top officers appointed especially and dedicated for sailing on vessels owned by the Company. The Ratings however, are not dedicated to sailing with vessels owned by the Company, which means they could sail with the company for one contract only or for several contracts, depending upon the time and the availability of positions for their rank when they seek employment. As for interviews with the Ratings, there could be a risk that some of them have rather limited knowledge of and experience from sailing with the Company. Hence their statements could rather reflect their general experiences and opinions regarding teamwork, not exclusively regarding the Company. According to Aubert and Arner (1962) and their sociological study, this however appears to be a common way of reflection for seafarers. Their findings implied that seafarers do not refer much to the particular vessel they are servicing at the time, rather to their experiences from their seafaring career in general (Aubert & Arner, 1962). This was also consistent with the students' understanding of the reflections from the participants in the study. Follow up questions specifically about their current situation were posed in an attempt to avoid obtaining statements only about the general experiences.

Transcribing and coding. The interviews were performed in English. As previously mentioned, some of the interviewees' knowledge and capability of expressing themselves in English involved some challenges. Particular shipping related words and phrases could potentially pose additional demands regarding the transcriptions and the coding. In an attempt to achieve the best possible understanding and in order to try and avoid misinterpretations, reading and talking to people in the industry to obtain knowledge about the maritime domain and the professional terms was part of the preparations for the study. Having limited experience with the life and work on board a vessel and not being familiar with the particular situations that were referred to, this was taken into consideration. In order to be as certain as possible about the meanings the participants were trying to get across, the students went carefully through the various steps in the process several times, conferring to check out that the understandings were consistent. It is still not possible to be 100% certain that there are no misunderstandings.

Coding. The coding of the interviews into various models involves determining what the statements are and scoring these into the SWOT model and into the Big Five model. This is a rather complex process comparing the meanings and statements to the understanding of the model and then the coding in several steps. The preparations, the interpretation of the components of the model, the processing of all the important and relevant information for the topic of the research can all influence the coding process. The process should be as transparent as possible and all relevant information regarding the study should be open and accessible for the research to be replicable. Being aware of this does not necessarily make it easier to accomplish in an ideal way, as some of the thoughts and considerations made during the process could be hard to relate to and describe, and therefore difficult to replicate. Although much effort was put into ensuring that the opinions from the participants were understood as correctly and precisely as possible, there is always a chance that utterings could be misinterpreted, and doubts about the meanings could arise later in the process.

Misconceptions regarding the contents and/or the meanings of the diverse components of the Big Five model could affect the coding process. Some of the aspects of the model appear to be rather extensive, containing a wide range of different elements, and some of the definitions and explanations are not as clear and as to the point as they could be. There are also some overlaps between some of the dimensions, which contribute in complicating the picture even further. Some of the statements could therefore be scored into a faulty category. There is also a risk that statements which should be coded and fitted into the Big Five, have been coded as not accounted for by the model.

Content analysis. When performing a content analysis, there is always a risk for misunderstanding the contents and the meanings expressed by the interviewees. The perception of the statements were discussed and double checked, and this showed that the understanding and the various possible themes and topics of the statements were highly consistent between the two students. However there could be statements referring to other themes and topics not discovered through the content analysis, and there could be statements coded according to a misinterpretation about the true meaning of the content of the statement.

Generalisation of findings. An important aspect in research is the possibility to generalise the findings. Due to the fact that the samples are not randomly picked and the sizes are relatively small, the question is whether the reflections from these participants' could be generalised as applicable for the whole organisational network in the complex system. The term semantic saturation in qualitative analysis (Kvale, 1996) refers to a point where further collection of data no longer seems to be necessary as no new information appear during the

interviews. The possibility for new themes coming up if there were more participants in the samples and more interviews were performed could not be excluded. This is however an empirical question, and should be investigated further through more research.

Interrater reliability. Investigation of the interrater reliability was on the agenda. Unfortunately this was postponed due to the fact that one of the students was prevented from completing the study at the time, and this happened before the interrater reliability was examined. Some parts of the transcriptions were cross-checked between the two students and no deviations were found. The interpretations of the contents of the Big Five dimensions, the initial content analysis, the preliminary proposal of themes for residual statements and much of the coding was performed by the two students together. There was a high degree of consistency and the two students were confident that they were well coordinated in the coding process. Due to the absence of a interrater reliability test, it is however possible that any potential differences between to two students were not taken into consideration.

Implications for Future Research

The findings of the study unveiled an overall confirmation of the Big Five of teamwork model's ability to capture important teamwork aspects across organisational levels and domains, however to a different extent and with different distribution on the various dimensions for the three teams. A considerable number of the statements relevant for the teamwork of the participants in the study were not covered by the Big Five model. This could imply that the Big Five model is not fully capable of capturing the reflections of teamwork for all the teams on various organisational levels in a complex system such as the maritime industry. Teamwork aspects considered to be relevant for the participants in the study are not implemented in the Big Five model. In order to examine the applicability, the validity, and the possible limitations of the model, it is proposed that more research should be conducted, and the model should be examined further including various team types involved in different team tasks in order to validate the Big Five model across different team types, including teams from different organisational levels and domains.

There was a difference between all the three teams regarding the number of statements about teamwork. Likewise the three teams also had a somewhat different profile as to the importance of the Big Five components, the aspects which the teams put the emphasis on as relevant for their teamwork. The same goes for the categories proposed for the statements not accounted for, the comparative importance of the various aspects seemed to vary across the teams. It could be worth looking further into this in order to find out whether it is connected to

the team type or to the team task, or whether the team is placed at the blunt end or at the sharp end of the complex system in this industry has any relevance for these findings.

A considerable number of statements from the teams in the study were not accounted for by the Big Five model. It could be worth carrying out a closer investigation looking even further into the contents of these statements, what kind of themes or topics they involve, whether these are task and/or team generic aspects or task and/or team specific (Cannon-Bowers et al., 1995). It could be useful to gain some understanding regarding why these aspects are considered to be relevant for the teams in this study, and find out whether these aspects apply only for these teams in particular, or whether they are relevant for these types of teams. There could however also be distinctive and specific conditions and features connected to the maritime domain which makes some of the themes or topics included in these categories relevant for the teamwork of these teams.

As for the number of statements from the different teams, the level of reflection of team members from various organisational levels could be worth investigating further. Could the difference in number of statements from the various teams, and thereby apparent difference in level of reflection, be connected to the team type, the complexity of the team tasks, the requirements connected to their work, the roles they hold and/or the responsibilities they possess? Or could the difference be connected to the organisational levels? More knowledge about this could be useful in accommodating the education, training and information to the various team members.

Conclusion

In this study the Big Five of teamwork model's ability to capture teamwork was tested through performing semi-structured SWOT based interviews with open-ended questions. The Big Five model captured 60% of all the statements generated through the interviews with participants from three teams from various organisational levels in a complex system in the maritime industry.

A considerable number of statements, 40% of the total statements, was not accounted for by the Big Five model. A content analysis of the residual statements revealed that these statements were also relevant for teamwork.

The results from the study showed differences between the teams from the various organisational levels in the complex system. The number of statements differed between the teams and in addition the view upon teamwork and the emphasis put on the various aspects of teamwork was also different, both for components within the Big Five model and for the

aspects not accounted for by the model. The differences between the teams regarding the number of statements and the distribution on the various components could indicate that the level of reflection upon teamwork varies across organisational levels. Thus the differences between the teams would not be due to the applicability of the Big Five model. The different view upon teamwork by the various teams could however also be connected to the fact that the team members of the respective teams have different roles to play, they are assigned to dissimilar responsibilities, they deal with highly different team tasks, and the objectives for their work are not the same. Hence implying that models aiming at capturing teamwork aspects in various teams should be more specific, and to a greater extent than is the case for the current Big Five of teamwork model take into consideration team specific and task specific aspects.

References

Argyris, C. (1990). *Integrating the Individual and the Organization*. New Brunswick, New Jersey: Transaction Publishers.

Arnold, J. (2005). *Work Psychology Understanding Human Behaviour in the Workplace* (fourth ed.). Harlow, Essex: FT Prentice Hall / Pearson Education Limited.

Arslan, O., & Er, I. D. (2008). A SWOT Analysis for Successful Bridge Team Organization and Safer Marine Operations. *Process Safety Progress, 27*(1), 21-28.

Ashkenas, R., Ulrich, D., Jick, T, & Kerr, S. (2006). Actions for Global Learners, Launchers, and leaders. In J. V. Gallos (Ed.), *Organization Development*. (pp. 888-913). San Francisco: Jossey-Bass.

Aubert, V., & Arner, O. (1962). *The Ship as a Social System*. Oslo, Norway: Institute for Social Research.

Bang, H. (2008). Effektivitet i ledertam - hva er det, og hvilke faktorer påvirker det? *Tidsskrift for Norsk Psykologiforening, 45*, 2-16.

Banister, P., Burman, E., Parker, I. Taylor, M., & Tindall, C. (1994). *Qualitative Methods in Psychology: A Research Guide*. Buckingham, Philadelphia: Open University Press.

Beckhard, R. (2006). What is Organization Development? In J. V. Gallos (Ed.), *Organization Development*. (pp. 3-12). San Francisco: Jossey-Bass.

Bjørkli, C. A. (2007). *Joint Cognitive Systems at Sea: A Study of High Speed Craft Operation.* Norwegian University of Science and Technology, Faculty of Social Sciences and Technology Management, Trondheim.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Acualitative Research in Psychology, 3,* 77-101.

Cannon-Bowers, J. A., & Salas, E. (1997). Teamwork competencies: The interaction of team member knowledge, skills and attitudes. In O. F. O'Neil (Ed.), *Workforce readiness: Competencies and assessment* (pp. 151–174). Mahwah, NJ: Erlbaum.

Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making. In J. Castellan, Jr. (Ed.), *Current issues in individual and group decision making* (pp. 221–246). Mahwah, NJ: Erlbaum.

Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining competencies and establishing team training requirements. In R. A. Guzzo, & E. Salas

(Eds.), *Team Effectiveness and Decision Making in Organisations*. (pp. 333-380). San Francisco: Jossey-Bass.

Celik, M., & Cebi, S. (2009). Analytical HFACS for investigating human errors in shipping accidents. *Accident Analysis and Prevention 41*, 66–75.

Charlsen, A.-C. M. (2009). *Teamwork as a Means to Safer Performance in the Shipping Industry*. M.Phil., University of Oslo, Norway.

Chauvin, C., Clostermann, J. P., & Hoc, J. M. (2009). Impact of training programs on decision-making and situation awareness of trainee watch officers. *Safety Science, 47*(9), 1222-1231.

Chermack, T. J., & Kasshanna, B. K. (2007). The Use and Misuse of SWOT Analysis and Implications for HRD Professionals. *Human Resource Development Management, 10*(4), 383-399.

Clarke, C., & Milne, R. (2001). National evaluation of the PEACE investigative interviewing course (pp. 196): Home Office.

Dekker, S. W. A (2005). *Ten Questions About Human Error - A New View of Human Factors and System Safety*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Dyson, R. G. (2004). Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational Research 152*(3), 631-640.

Eby, L. T., & Dobbins, G. H. (1997). Collectivistic orientation in teams: an individual and group-level analysis. *Journal of Organizational Behavior, 18*, 275-295.

Emad, G., & Roth, W. M. (2008). Contradictions in the practices of training for and assessment of competency: A case study from the maritime domain. *Education + Training, 50*(3), 260-272.

Flick, U. (2002). *An introduction to qualitative research*, (2nd ed.). London: Sage Publications Ltd.

Furnham, A. (2005). *The Psychology of Behaviour at Work. The Individual in the Organization*. Hove, UK: Psychology Press.

Gallos, J. V. (2006). Reframing Complexity: A Four-Dimensional Approach to Organizational Diagnosis, Development, and Change. In J. V. Gallos (Ed.). *Organization Development*. (pp. 344-362). San Francisco: Jossey-Bass.

Grech, M. R., Horberry, T. J., & Koester, T. (2008). *Human Factors in the Maritime Domain*. Boca Raton, FL: Taylor & Francis Group.

Grenness, C. E. (1999). *Kommunikasjon i organisasjoner. Innføring i kommunikasjonsterori og kommunikasjonsteknikker*. Oslo: Abstrakt forlag as.

Gudelj, A., Krcum, M., & Krcum, P. (2008). The role of information technology in maritime education for hazard avoidance. *International Journal of Emergency Management, 5*(3), 219-234.

Hetherington, C., Flin, R., & Mearns, K. (2006). Safety in shipping: The human element. *Journal of Safety Research, 37*, 401-411.

Hoff, T., Flakke, E., Larsen, A.-K., Lone, J. A., Bjørkli, C. A., & Bjørklund, R. A. (2009). On the validity of M-SWOT for Innovation Climate Development. *Scandinavian journal of organizational psychology, 1*(1), 3-11.

Hollnagel, E. (2004). *Barriers and Accident Prevention*. Aldershot, Hampshire, England: Ashgate Publishing Limited.

Holsti, O. R. (1969). *Content Analysis for the Social Sciences and Humanities*. Reading, MA: Addison-Wesley Publishing Company, Inc.

Håvold, J. I. (2005). Safety-culture in a Norwegian shipping company. *Journal of Safety Research, 36*, 441-458.

Imset, J. (2008). *Assessing the "Leading Indicators" of Safety Climate in the Shipping Industry.* M.Phil., University of Oslo, Norway.

Johannessen, A., Tufte, P. A., & Kristoffersen, L. (2005). *Introduksjon til samfunnsvitenskapelig metode*. Oslo: Abstrakt forlag as.

Kay, J., Maisonneuve, N., Yacef, K., & Reimann, P. (2006). The Big Five and visualisations of team work activity. In M. Ikeda, K. Ashley, & T.-W. Chan (Eds.), *ITS 2006* (pp. 197-206). Berlin, Germany: Springer-Verlag Berlin Heidelberg.

Kotter, J. (2006). Relations with Superiors: The Challenge of "Managing" a Boss. In J. V. Gallos (Ed.), *Organization Development*. (pp. 501-517). San Francisco: Jossey-Bass.

Krippendorff, K. (2004). *Content Analysis An Introduction to Its Methodology*. (second ed.). Thousand Oaks, California: Sage Publications, Inc.

Kvale, S. (1996). *InterViews. An Introduction to Qualitative Research Interviewing*. London: SAGE Publications Ltd.

Maritim21. (2010). Retrieved October 19, 2010, from http://www.regjeringen.no/upload/NHD/Vedlegg/rapporter_2010/Maritim21.pdf

Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science 41*(8), 641-680.

Meister, D. (1989). *Conceptual Aspects of Human Factors*. Baltimore, Maryland: The Johns Hopkins University Press.

Milne, R., & Bull, R. (2003). Interviewing by the police. In D. Carson & R. Bull (Eds.), *Handbook of psychology in legal contexts* (2nd ed.). West Sussex: John Wiley & Sons Ltd.

Mintzberg, H. (1994). *The Rise and Fall of Strategic Planning*. New York: The Free Press.

Neuendorf, K. A. (2002). *The Content Analysis Guidebook*. Thousand Oaks, CA: Sage Publications, Inc.

Norros, L., & Nuutinen, M. (2009). Learning from Accidents: Analysis of Normal Practices. *Risky Work Environments: Reappraising Human Work Within Fallible Systems*, 17.

Northouse, P. G. ((2004). *Leadership: Theory and Practice*. Thousand Oaks, California: Sage Publications, Inc.

Payne, S. (2000). Interview in Qualitative Research. In A. Memon, & R. Bull (Eds.), *Handbook of the Psychology of Interviewing* (pp. 89-102). Chichester, West Sussex, England: John Wiley & Sons Ltd.

Perrow, C. (1999). *Normal Accidents: Living with High-Risk Technologies.* Princeton, New Jersey: Princeton University Press.

Rasmussen, J (1990). Human error and the problem of causality in analysis of accidents. In In D. E. Broadbent, A. Baddeley, & J. T. Reason (Eds.), *Human Factors in Hazardous Situations* (pp. 1-14). New York: Oxford University Press.

Rattleff, J. (1992). *Introduksjon til kvantitative metoder i Psykologisk forskning*. Brøndby: Semi-forlaget.

Reason, J. T. (1990). *Human Error*. Cambridge, UK: Cambridge University Press.

Salas, E., Burke, C. S., & Cannon-Bowers, J. A. (2000). Teamwork: emerging principles. *International Journal of Management Reviews, 2*(4), 339-356.

Salas, E., Cooke, N. J., & Rosen, M.A. (2008). On Teams, Teamwork, and Team Performance: Discoveries and Developments. *Human Factors, 50*(3), 540-547.

Salas, E., Dickinson, T. L., Converse, S. A., & Tannenbaum, S. I. (1992). Towards an understanding of team performance and training. In R. W. Swezey, & E. Salas (Eds.), *Teams: their Training and Performance* (pp. 3-29), Norwood, NJ: Ablex.

Salas, E., Sims, D. E., & Burke, C. S. (2005). Is there a "Big Five" in Teamwork? *Small Group Research, 36*(5), 555-599.

Salvesen, B. B. (2008). *Managing Risk in the Shipping Industry: Methodological, Theoretical and Applied Implications for Safety Climate Research.* M.Phil., University of Oslo, Norway.

Sasou, K., & Reason, J. (1999). Team Errors: Definition and taxonomy. *Reliability Engineering and System Safety, 65*, 1-9.

Sjøvold, E. (2006). *Teamet - utvikling, effektivitet og endring i grupper*. Oslo: Universitetsforlaget.

Straumsheim, P. A. (2007). *Assessing psychological work environments: A comparative study of survey instruments and interviews*. M.Phil, University of Oslo, Norway.

Sundstrom, E. (1999). *Supporting Work Team Effectiveness: Best Management Practices for Fostering High Performance*. San Francisco: Jossey-Bass Inc.

Svedberg, L. (2002). *Gruppepsykologi. Om grupper, organisasjoner og ledelse*. Oslo: Abstrakt Forlag AS.

Vicente, K. J. (1999). *Cognitive Work Analysis. Toward Safe, Healthy, and Productive Computer-Based Work*. Mahwah, N.J.: Lawrence Erlbaum Associates, Inc.

Vicente, K. (2003). *The Human Factor: Revolutionizing the Way People Live with Technology*. New York: Routledge.

Wagenaar, W. A., & Groeneweg, J. (1987). Accidents at sea, causes and consequences. *International Journal of Man-Machine Studies, 27*, 587-598

Weintrit, A. (Ed.). (2009). *Marine Navigation and Safety of Sea Transportation*. London: Taylor & Francis Group.

West, M. A. (2004). *Effective Teamwork. Practical Lessons from Organizational Research*. (second ed.). Malden, MA: BPS Blackwell.

Woods, D.D., Johannesen, L.J., Cook, R. I., & Sarter, N. B. (1994). *Behind Human Error: Cognitive Systems, Computers and Hindsight*. Columbus: CSERIAC.

Østreng, D. (2007). *I samme båt. Forholdet mellom sjøfolk på multinasjonale skip*. Oslo, Norway: Unipub AS.

Appendix A

Interview Guide

SWOT Based Questions

1. What do you think is positive when it comes to teamwork in your job environment?
2. What do you think is negative when it comes to teamwork in your job environment?
3. How could teamwork be even better?
4. What kind of problems could prevent better teamwork?

Follow Up Questions

- Could you please tell me more about….
- Could you please exemplify….
- How about….
- Can you explain what you mean with that?

Appendix B

Information letter/Informed Consent

We are very grateful that you have taken the time to let us interview you. We are Master's degree students in psychology at the University of Oslo. This year we will be writing our Master's thesis in cooperation with the Company's top management, evaluating how teamwork influences safety initiatives.

Data from this interview will, together with all the other interviews we will be performing, create the basis for our analysis. The aim with this interview is to gain knowledge, insights and understanding of what you have experienced, what your views are and your thoughts and feelings concerning teamwork in the organisational network, with an emphasis on the human side of safety.

We would like to tape record the interview so that important information will not be lost or forgotten. Only the two of us, together with our supervisors at the university will have access to the recordings. All the information you will be giving is anonymous and confidential. All names and personal identification will be deleted in the final thesis, and it will not be possible to trace any information back to you. Nothing you say will be known to any of your colleagues or to your employer. However, if you do not feel comfortable with recording the interview, we would like you to tell us, and the interview will not be recorded. Your participation is voluntary and you may, at any time, choose to end the session if you wish to do so. By answering the questions, you will give your consent to participate in this research.

The interview will be based on a technique called SWOT-analysis, aiming to shed light upon four aspects of teamwork and safety within the organisational network - strengths, weaknesses, opportunities and threats. The questions will be very open and general, so the focus in the interview will be largely up to you to decide. No answers are considered more correct than others; the only thing we are interested in is your honest opinion.

Date and place/Signature, interviewer	Date and place/Signature, interviewee

Appendix C

Statements not Accounted for by the Big Five

Categories - Explanation of Contents

Communication channel
Team members of the teams in the organisational network involved in the study are often situated at separate locations. This may be separate locations ashore, different places on board a vessel, different places both at sea and ashore, or members of the team could be on their way travelling from one location to another. The availability and the quality of the various means of communication, and the possibility for communication with others is important for the team members, and can either facilitate or hamper their communication, thus influence the quality of the communication among the team members. Hence the means of communication and how well it works becomes of vital importance for the teamwork functioning (Beckhard, 2006; Furnham, 2005).

Competencies
The suitable and desired specific characteristics, and the observable behaviours and behaviour patterns positively associated with job performance. This includes sufficient knowledge and skills required to handle the job and to perform the relevant tasks in a proper way, and the ability to complete the tasks and cope with the challenges that may turn up in a certain job or position. The category includes organised education or training efforts to provide employees with structured opportunities to learn and develop within their work role, in order to maintain and update the knowledge, the skills and the ability needed for performing the job. It also includes retraining or deepening of the knowledge in particular fields, in order to develop and improve knowledge and skills aiming at raising the personnel's level of performance and to adjust to new demands, rules and regulations (Arnold, 2005; Furnham, 2005).

Diversity
Diversity in national origin, race, gender, age, culture, and traditions can imply differences in opinions, values, creeds and beliefs which again could be expressed through considerable differences in the approach in how to behave in teams. It also involves differences in business methods and practices, cultural (however not individual/personal characteristics and attitudes) attitudes, and values, and socialisation customs (Ashkenas, Ulrich, Jick, & Kerr, 2006; Arnold, 2005; Furnham, 2005).

Environment - climate
The space and the possibilities in the team, organisation and industry, for discussing issues and speaking up. Informal framework regarding the feelings, thoughts and behaviours which are acceptable and approved of in the team and in the organisation, and among the crew on

board the vessels in their time off work and duty. The personnel's perceptions of how the organisation and how their teams function, and what kind of social norms and rules that are applicable, also outside the working hours, as work and free time overlap for the team members in some of these teams. Shared ideas about how things should be. (e.g. "This is how we do it - this is how things are done here!") For the crew on board the vessels food is considered an important part of the environment (Arnold, 2005; Svedberg, 2002).

Experience
Suitable education, knowledge, skills and abilities, shaped, developed, improved and combined through experiences acquired over time practising the profession, addressing increasingly complex problems, examining present behaviour, experimenting and trying out alternatives and practising modified ways of behaviour. This in order to be better prepared than only through what one can read in and learn from books and from only having practised the profession for a short while. Through confrontation with progressively more complex problems, obtain higher levels of conceptual capacity, and achieve a certain kind of understanding for the profession, for the industry, and for all it's challenges which only comes from having practised and lived it long enough (Beckhard, 2006; Northouse, 2004).

Group identity
A feeling of emotional attachment to the group, to the team or the organisational network, a sense of belonging to and being part of the group, of the team or the organisational network, hence resulting in a feeling of normative commitment and loyalty towards the team, the organisation and the industry, based upon a person's sense of obligation and responsibility to their organisation. The sharing of some aspects of the self-concept you think you have in common with others in the same group, which differentiate you from members of other groups (Arnold, 2005; Furnham, 2005).

Human resource management
An overall framework regarding the management of the human resources in the work place. This involves manpower issues in general, the availability, allocation and use of manpower. Planning, recruitment and personnel selection, and other issues regarding staffing the organisation, ensuring that competent, adequately educated and experienced staff and crew are available where and when needed, putting the right person in the right place and the right position, and make certain that the person is treated in such a manner that he or she will remain in the organisation. Retention is applicable for contracted employees in the sharp end teams (Arnold, 2005; Gallos, 2006).

Individual characteristics
Each and every person is different, and individual or personal characteristics include many various elements. Here it involves the individual's personal attributes and attitudes, which may influence their approach and predispositions to act towards the team and other team members or towards some aspects of that person's environment in a specific manner. These characteristics may influence the person's tendency to emphasise on promoting individual interests over team and organisational interests, and to give own interests, demands, needs and personality traits priority over constructive interaction with others, for the sharp end team members it also applies for their time off work (Arnold, 2005).

Interaction - relations
The complex interplay between individuals, groups, organisations and work. The interpersonal relations among the team members when at work and also outside the working hours. How the interaction between the people involved functions, how they relate to each other, how they address one another, how they treat each other, interpersonal and group dynamics. This also includes social support, mutual and constructive behavioural feedback, expressing appreciation, blame, socialising, social activities, spending time with other team members in their free time (Furnham, 2005; Grenness, 1999; Kotter, 2006).

Personal life versus work life
The ”home” or personal life and work interface; How the work life and the need for personal time is fitted and goes together, which ideally is thought of as intertwined and existing in harmony with each other. The balance between people’s time spent on duty and work tasks, and the time off work and duty. This could mean an extra challenge for the sharp end team members, with both their temporary ”home” and the work place at the same location. If the focus is constantly on work- and task related issues, the time, space, and possibilities for fulfilling the need of personal time, enjoying some privacy and be involved in other activities may be too limited. When crew members are in their work place 24/7 for a long period of time, it means that they are not available at home to take care of the domestic responsibilities while on board the vessel, and the work must necessarily interfere with the consideration of family and personal life. If a sharp end team member has domestic problems it could likewise result in family interference with work, potentially disturbing that person’s work motivation and focus (Arnold, 2005).

Structure
The structural frames and the structural context of the organisational network, the companies involved, the industry, environmental considerations and precautions, the various authorities involved and other parties outside the boundaries of the organisational network itself that may imply some constraints which constitute a framework that needs to be considered also when it comes to team and teamwork issues. Regulations, goals and demands, policies, roles, task descriptions, job designs, job descriptions, technology, environment, chain of command such as the hierarchy on board the ships, vertical and horizontal coordinating mechanisms, assessment and reward systems, standard operating procedures, authority spans and structures, spans of control, specialisation and division of labour, information systems, formal feedback loops, forces, conditions.

This also includes the allocation of limited financial resources and/or other organisational assets, and availability of facilities. The location of the parties constituting the organisational network and the ship as a community of its own, which is more or less like an isolated fit in many ways. Changing crew on board the vessels, the time on board limited according to contract, or the contract that may be extended due to reliever not available and/or port access not possible (Arnold, 2005; Gallos, 2006).

Appendix D

Residual - Categories

Statements not accounted for by the Big Five model

Among the 1901 SWOT statements generated through the interviews in this study, 757 statements, amounting to 40% of the statements, were not accounted for by the Big Five model. Content analysis of the residual revealed that these statements involved important aspects relevant for the teamwork of the teams participating in the study. The further process of analysis showed that the statements could be connected to 11 different categories. As for the definitions and explanations of the contents of these categories, please see Appendix C.

Below is an overview of the categories, short information regarding the choice of the particular labels, explanations regarding the relevance for the teamwork in these teams and this domain, and examples of the statements fitted into the respective categories.

The categories proposed to cover the statements not accounted for by the Big Five model include a variety of aspects considered to affect teamwork functioning in the participating teams. Some of the aspects are mostly related to internal conditions, and may be influenced by the team members and by the team itself. Other dimensions are more related to external factors, on which the team members do not have a great deal of influence. It could however still be useful and even important to take these aspects into consideration when designing teams and planning teamwork in this domain.

All the residual categories, apart from two, held statements from all the three teams. Two of the categories, *Communication channel* and *Human resources management*, held statements from only two of the teams, the Top officers and the Core team. Both of these categories contain statements that could be associated with leadership responsibilities, hence part of the tasks of the two teams that held statements coded into these aspects. The members of the Ratings team would normally not have any influence on tasks related to these topics, and therefore not perceived as any primary concern for them when considering relevant aspects of their teamwork.

The categories and example statements

Communication channel

The statements which was fitted into the category Communication channel, was rather specific regarding the means of communication. Initially these statements were considered coded under the Structure label, however the interviewees' concern was not regarding the availability of the equipment and the systems per se, but more as to how the means of communication affect the possibility for and the quality of their communication. It was proposed that good quality communication through well functioning communication channels could enhance and improve their teamwork, or opposite if the team members are not able to communicate with each other as required the teamwork could be hampered. A well functioning communication can be of vital importance for team members on various locations in the organisational network, in order to complete their tasks and achieve their goals.

Example statements:

"-in the operation, via the radio very often - it's effective"

"-the change in technology has resulted in people demanding immediate solutions. When you send an email you want an answer in five minutes"
"-they can communicate with us directly. It automatically goes to the master, so he sees it. We're actually wondering if we should extend the team further, there's mixed thought about that, mixed feelings about that, because we do not want hundred messages coming from one ship"

Competencies
Before naming the category Competencies, the preliminary labels included knowledge and skills, education, learning and training, as well as development and improvement. Later these labels were put into the same category, as the label Competencies is considered to cover them all. Many of the participants in the study were particularly concerned with the newcomers on board, and their ability to perform their tasks as required from day one. It was also proposed that general learning and training in order to update and deepen the knowledge and perfection the skills should be a general and lasting offer for the personnel as a normal procedure, irrespective of the team leader.

Example statements:
"-normally nowadays for people coming on board, they are generally quite confident. So everybody knows what is their work"
"-I have a technical knowledge about things, so it makes it much easier for me to explain things and understand things"
"-the people that did the biggest mistakes are still here. We have put them through schools, trainings, teaching, and brought them back. And hopefully they come back as a better person"

Diversity
The label Diversity includes statements connected to diversity in culture and language. (For other diversity issues; See the category Individual characteristics). The maritime domain is a global industry, with both multinational crews on board the vessels and shore based teams located all over the world with team members from different countries and with various cultural backgrounds. Consequently there could be a number of issues connected to the team members' various national and cultural backgrounds in this context, which could potentially involve some extra/particular challenges in regards to diversity in connection with these aspects, therefore this label was considered to be appropriate.

Example statements:
"-whatever I think I can speak, I don't feel any problem in language"
"-the language barriers"
"different nationalities have different mind and different ideas."

Environment - climate
The Environment - climate category does not include statements only regarding the environment and climate related directly to the organisation, to the work and the team task. It also includes the acceptance of or the expectations regarding people speaking up, how the communications regarding the pressure is and how it is perceived, how considerations for people's health and welfare is taken care of in the environment. The category also includes job satisfaction. Some may argue that this can be perceived as a part of the Big Five

dimension Team leadership, but going through the SWOT statements while coding, the conclusion was these statements should be coded under a separate label as environment and climate, as job environment and organisational climate would not be the correct expression, as this applies both to the professional environment and to the private sphere.

Example statements:
"-if they have good food, they're happy, and the efficiency of work increasing"
"-everything on board, it's, how to say, more sensitive, more exposed, more stronger that on the shore."
"-that's their living space, that's their working space, their office, workplace, everything is the same. And it - you bring it as close to real life as possible. Then you have very dedicated people, very motivated people"

Experience
Many of the participants in the study enhanced Experience as important to their teamwork. This theme seems to be highly relevant due to the fact that there is a general shortage of officers world wide in the maritime industry, and there is some concern that it may lead to too early promotions before the seafarer has gained enough practise in the profession and is ready for further challenges and more responsibilities. The mandatory education and training is always completed, however a certain amount of practising of the skills in their profession is necessary to acquire further know-how and develop their skills in order to be able to handle all possible challenges they could be facing in their day to day handing of their job in the best possible way.

Example statements:
"-theoretical, how to do it, but not in practise sometimes"
"-once they get familiar with our system it's much easier for everybody, for them on board and for us also. In fact the oil companies have realised this and that's one of the - they have something called the matrix, where they say that the combined experience in rank and the company should be a certain amount for, say captain and chief mate"
"-what they're doing now is they say if you won't promote me, I will go next door and they'll promote me"

Group identity
It was considered whether the statements fitted into Group identity could be one of the elements of the Team orientation component of the Big Five model. The message contents of these statements were however referring to group identity or social identity and the sense of belonging to the group as such as in the meaning of an individual's attachment to the group or the team independently of the person's function or role connected to the team tasks and work-specific and -related aspects, as was perceived to be the focus of the Team orientation component in the Big Five model. This aspect appears to be important for team members in the domain, especially for the sharp end teams, being far away from family and friends for months at a time.

Example statements:
"-so everybody like a family, you know. Our ship is like a house"
"-that also helps in contributing to teamwork, that they feel as a part of the group"

"-if they are gonna come maybe for one contract and then they leave and go and join some other company; They are never going to feel part of the team unless their intention is to continue."

Human resources management
The category Human resources management was initially related to several separate labels connected to such aspects as recruitment, selection, retention, turnover, and manpower, which however all could be connected to the management of the personnel, or arrangements and organisation regarding the human resources. These functions are not mentioned as a part of any of the components of the Big Five model, however seem to be of concern for two of the teams in the study, having team members with leadership roles and responsibilities.

Example statements:
"-the selection process is probably important in order to get the right people who are interested in staying for a while in our team"
"-huge shortage of people world wide"
"-if you want quality you have to pay more"

Individual characteristics
The aspect labelled Individual characteristics (personal characteristics) includes statements regarding a person's predispositions or attitudes. Not considered as part of the Big Five component Team orientation, as they refer to these aspects in general, not only related to the task, and often also
influencing their day to day life on board the vessels, relating to the same individuals always, both while on duty and in their time off work.

Example statements:
"-positive thinking"
"-if some kind of ego coming in between the relationship"
"-here and there happens black lamb in the tribe - in the group"

Interaction - relations
The category named Interaction - relations involves the common way people address each other, how they communicate and how they interact with each other in their common environment. Topics such as appreciation, blame, feedback, socialising, and social activities are included in the category. For the majority of the participants in this study it involves how people interact and relate to one another in general, not merely while carrying out the team task, maybe even more so during their leisure time. Ensuring good general relations between the people in an environment where the individuals relate to the same people both during work hours and in their free time, may be challenging, nevertheless also important as it could potentially be highly influential on all aspects of their functioning, also for each individual's involvement and contribution in their teamwork.

Example statements:
"-if you care about other people, they care about you"
"-after finished dinner we'll meet all together in the recreation room, or stay in someone else's cabin and just talk about common things, you know, just talking friendly"

“-if it is first time you come there is no problem to load or discharge the ship, but the problem is, how to get along with those people”

Personal life versus work life

Even though the aspect named Personal life vs. work life is relevant for all the teams, it is expected that this issue is more relevant for the teams on board the vessel. The interface private life (home life) and work life involves the balance between the working hours and the time off work and the people’s need for personal space and a private life. This could be a challenge for team members on board the vessels, with their home and work place in the same environment. There is no mention about this issue in any of the Big Five of teamwork dimensions.

Example statements:

“-everybody is homesick, whether they are telling or not telling”
“-if you only think about your work all the time”
“-someone who has trouble with at home”

Structure

Early in the analysis process the category Structure originally consisted of several labels such as role clarity, task clarity, length of contract, changing crew, and manpower-resources. The latter was later split in two with manpower placed under Human resources management, and resources places under Structure. In addition to the above mentioned aspects this label also includes financial and other material resources and supplies, equipment, tools etc. and also facilities, as in offices, conference rooms, and gym/training facilities. Structure can be perceived as some sort of framework that the team has to operate in accordance with and relate to in their teamwork. This framework is to a large extent directed and regulated according to the structure of the organisational network, and also according to international rules, regulations, and requirements in the industry.

Example statements:

“-different people is coming, so a little bit of - it take time to understand the situation”
“-it’s not like on shore where you can get help from someone when you need it”
“-maybe you’ve finished your ‘contracted time’ and you’re ready to sign off, you’re counting your days. That time the ship will sail out for somewhere else and in between you’re passing two-three months, sometimes that happens. That time some people become crazy”